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MASTER THESIS

Vilniaus vertybinių popierių biržoje listinguojamų įmonių finansinių rezultatų ir akcijų grąžos ryšio nustatymas	Determining the relationship between the financial results of companies listed on the Vilnius Stock Exchange and the return on shares

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ABBREVIATION LIST

AMEX – American Stock Exchange

AR – Autoregressive model

ARDL – Autoregressive Distributed Lag model

B/M – Book-to-Market value ratio

C/P – Cash flow-to-Price ratio

CAPM – Capital Asset Pricing Model

CPI – Consumer Price Index

E/P – Earnings-to-Price ratio

EGARCH - Exponential General Autoregressive Conditional Heteroskedastic model

EPS – Earnings Per Share

EVA – Economic Value Added

FDI – Foreign Direct Investment

GDP – Gross Domestic Product

GLS – Generalized Least Squares

IFRS – International Financial Reporting Standards

IRF – Impulse Response Function

MSFE – Mean Squared Forecast Error

MVA – Market Value Added

NASDAQ – National Association of Securities Dealers Automated Quotations

NYSE – New York Stock Exchange

OLS – Ordinary Least Squares

P/E – Price-to-Earnings ratio

POLS – Pooled Ordinary Least Squares

ROA – Return On Assets

ROCE – Return On Capital Employed

ROE – Return On Equity

ROI – Return On Investment

S&P – Standard and Poor

SBI – Indonesia Bank Certificate

TTM – Trailing Twelve Months

INTRODUCTION

Prices and returns on business shares are the primary financial measures for many counterparties (i.e. management, shareholders, potential investors, and so on) and determine the firm's success, management effectiveness, and income for shareholders. Stock prices are a volatile metric that may fluctuate due to changes in the economic climate, disclosures of new information about the firm, changes in a country's political status, or even anomalies caused by calendar events. Moreover, one of the main factors influencing the development of stock prices in equity markets is a return on shares' relationship with other indicators, such as macroeconomic variables, company characteristics, financial results, and accounting information, among many others. In this study, the relationship between a company's financial results and fluctuations in its stock price is examined.

Financial results give an insight into a firm's financial and operational performance. Their relationship with equity market returns in this research is investigated in two main ways: as determinants of share returns and as variables helping to forecast changes in companies' stock prices. These types of relationships are examined both in theoretical analysis based on scientific papers in the literature and empirical analysis where econometric models are built to test described interconnections.

Determinants and predictors of returns on shares are widely studied topics among scholars all over the world. In this study, scientific papers from all continents are analyzed, covering equity price dynamics in stock exchanges from various countries, which allows to overview factors influencing stock returns in different economic, financial, legal, and political environments. Furthermore, researches about the effect of numerous indicators on the development of share prices are examined in dissimilar time periods and by utilizing distinct methodologies, permitting a comparison of the outcomes between separate set-ups, states, and circumstances, yielding evidence-based conclusions.

In Lithuania, there is a limited amount of research conducted on financial results' relationship with share returns, as most of the papers focus on macroeconomic variables as fundamental determinants of equity price returns. Therefore, the goal of this research is to examine the company's financial metrics as potential determinants and predictors of equity market returns in the Vilnius Stock Exchange. It is achieved by utilizing values from accounting statements of listed firms in Lithuania and by employing econometric methods used in similar researches focusing on capital markets in other countries.

Based on the findings of scholars using data from different countries, a set of financial results and accounting values indicators were chosen for an analysis of their relationship with returns on shares in the Vilnius Stock Exchange. It is constituted of four different profitability ratios (*ROA, ROE, EPS, net profit margin*), cash flow ratio (*operating cash flow*), valuation ratio (*P/E*), efficiency ratio (*total asset turnover*), solvency ratio (*financial leverage*), and a variable representing firm's dividend policy (dividend per share). Such a combination of variables is chosen in order to extensively disclose the company's financial performance.

The predictive power of financial metrics is examined using autoregressive distributed lag model (ARDL) models for each predictor, comparing obtained results with the benchmark autoregressive (AR) model. Individual forecasts are also merged using a simple mean approach in order to get combination forecasts and potentially improve the forecasting abilities of the company's financial results. Different econometric methods are applied in this study to test the following six hypotheses about the relationship between returns on shares and financial results in Vilnius Stock Exchange:

1) Financial metrics significantly impact stock returns in simple linear regression
2) There is no multicollinearity between chosen independent variables
3) Certain measures of financial results substantially impact the returns of shares
4) Financial results explain most of the variation in share returns
5) Forecasts with individual financial ratios outperform benchmark forecasts based on historical share return data
6) A combination of individual forecasts made using the company's financial information improves the predictive power of the model

Tests of these hypotheses are considered to be the main objectives of this research, which will allow to reach the desired goal (determine the relationship between indicators reflecting the financial performance of the companies and its stock returns).

The rest of the dissertation is structured in the following way: the first section reviews the scientific papers about determinants and predictors of share returns in all continents of the world, allowing to choose potential indicators and models for this research. The second section describes the applied methodology and financial metrics used in this study. While the third section presents the results of empirical analysis for both financial ratios as determinants and predictors of changes in stock prices.

1. DETERMINANTS AND PREDICTORS OF STOCK RETURNS IN THE LITERATURE

Due to the importance of stock returns on investors, shareholders and company's management decisions factors affecting their value are widely discussed in the literature by scholars all around the globe. Studies about stock price relationship with key financial metrics date back to the 4th decade of the 20th century when Graham, Dodd and Cottle (1934) wrote a paper about the benefits of valuing prices in the equity market based on the price-to-earnings ratio (P/E), which was the common approach at that time. However, the inclusion of other indicators into the list of potential determinants of stock returns developed gradually over the years, which can be illustrated by the fact that Ball's and Brown's research conducted in 1968, was one of the first attempts to study the relationship between accounting information and capital market returns. Ball and Brown (1968) found that returns of shares are highly impacted by announcements of accounting information, using annual net income and dividend per share prediction errors as main financial results. Since that time, numerous amount of researchers examined the subject of share return determinants in various countries, discovering compelling results, which in some cases are contradictory to each other due to country-specific environment, analysis of different time periods, and dissimilar methodologies applied in the research.

Moreover, the ability to determine stock price movements in advance is one of the main and most important goals of investors and financial analysts, since it is really powerful information, which helps to plan and sensibly make investment choices, recognizing an expected outcome. Determining the relationship between various economic and financial variables (financial statements information, accounting information, macroeconomic metrics, etc.) is significant in equity markets research because analysis of these characteristics empowers to come up with the framework, which can be utilized to gauge potential returns, profits, and economic value. Therefore, finding variables that help to predict stock returns is a field of interest in many scientific papers as well differing from the researches about determinants of stock returns, in a sense that variables, which may be performing well in-sample and have established relationship with equity market returns, might perform poorly in out-of-sample forecasting exercises, being not valuable predictors of future share price developments.

In this section, I review studies of scholars on determinants of returns in capital markets, together with researches on variables that are useful in forecasting future stock returns compared to the benchmark model. Literature is analysed by splitting scientific papers based on the country that they are focusing on, since according to the findings by Schrimpf (2010), there are substantial

differences in the degree of out-of-sample and in-sample predictability across international capital markets, suggesting that with all else being equal country of interest could be the main factor influencing dissimilar outcomes between analyses.

1.1. **Variables affecting returns of share prices in different countries**

For a long period of time in financial literature and analysis most popular concept explaining returns of stock prices was the capital asset pricing model (CAPM), which, according to Perold (2004), was developed at the beginning of the 1960s by Jack Treynor (1962), William Sharpe (1964), John Lintner (1965a, b) and Jan Mossin (1966). CAPM model states that expected returns of investment are defined by the riskiness of the security, being equal to the sum of the risk-free rate and risk premium, which is dependent on security's systematic risk (beta coefficient). Although the CAPM model due to its simplicity is still used in some instances as a method to assess costs of equity, succeeding researches confirmed that the CAPM model performs poorly in empirical tests (Fama and French, 2004; Perold, 2004), since changes in share prices are affected not only by the riskiness of the stock and can be country-/region-specific.

One of the factors that theoretically is crucial in the identification of stock returns and comparison of their differences between companies is financial and accounting information since they define the actual company's performance. Although not being included directly in the CAPM model, financial performance indicators are one of the oldest financial analysis tools used in an overview of the company when making investment decisions and carrying out an operational assessment. Thus, financial ratios and accounting figures of the companies are one of the most widely discussed potential factors affecting share returns in the literature.

Due to the absence of a theoretical model which can universally explain returns of share prices, scholars from all around the world are trying to detect variables that are influencing movements of stock returns in their country or internationally from the list of different potential determinants, including financial results and ratios of the companies.

1.1.1. **History of companies' financial results impact on stock price analyses in the United States market**

Most of the researches about stock exchanges in North and South America are conducted in the United States, focusing on its financial markets. United States, being the largest economy in the world, has the largest equity market as well, with more than 40% of global equity market capitalization represented in US and approximately 23 trillion dollars of stocks traded during the year, according to the World Bank 2020 data. Counting more than two hundred years of history,

the US capital market distinguishes itself as a core of the world's financial sector and has one of the broadest data availabilities in the world. Therefore, most extensive and universal studies about variables substantially influencing developments of share prices throughout the history are carried out in the United States.

The best-known analysis about determinants of stock returns in the United States was conducted by Fama and French (1992), nominated for a Nobel Prize. Scholars used a cross-sectional panel data regression model to study the relationship between stock return in the US equity market and variables hypothesized to explain expected returns, namely financial leverage, firm size, the ratio of book value to market price, the ratio of profit to expected stock returns and the firm's systematic risk coefficient (Beta). Fama and French (1992) use the New York Stock Exchange (NYSE), American Stock Exchange (AMEX, currently known as NYSE American) and National Association of Securities Dealers Automated Quotations (NASDAQ) returns data for nonfinancial companies, as well as annual industrial files of balance sheet and income statement data for a 1963-1990 time period. Since all of the potential indicators considered in Fama and French (1992) analysis were a scaled versions of price, the expected result of this study was that some of them are redundant. Indeed, this research suggested that market risk coefficient Beta is not able to solely explain changes in stock prices, as it was modeled by CAPM. Moreover, scholars found that for the 1963-1990 period out of all considered share return determinants, easily measured firm size (market equity) and book-to-market value ratio capture most of the cross-sectional variation in the United States equity market's average stock returns, associated with financial leverage, size, earnings-to-price and book-to-market equity (Fama and French, 1992). As a concluding recommendation, Fama and French (1992) extended the CAPM model by including value and size factors of the firms, which is called Fama–French three-factor model and was found to explain more than 90% of the diversified portfolio returns within the sample while, for comparison, CAPM model tends to on average explain around 70% of the returns.

In the following studies, Fama and French (1993, 1995, 1996, 1998) continued their analysis of share returns' determinants and demonstrated that there is no significant impact from systematic risk coefficient (Beta) to changes in stock prices when controlling for firm size and book-to-market value, which further undermines CAPM findings. In addition, scholars showed that companies with high cash flow to price (C/P), earnings to price (E/P), and book-to-market equity values (B/M), in the literature called value stocks[1], experience value premium in average

[1] A value stock is the opposite of a growth stock since it defines shares of a company, which is undervalued (i.e. its trading price is below the one indicated by fundamentals and company's performance) and provides long-run investment opportunities since it takes time for the market to change the perception of the company. Due to lower

stock returns, which is a compensation for a risk missed by the CAPM model (Fama and French, 1993, 1996, 1995, 1998). Therefore, the main conclusion from Fama and French (1992, 1993, 1996, 1995, 1998) studies is that the CAPM model can be substantially improved, since the ratio of book value to market price and firm size have a significant impact on stock returns, with the explanatory power of other hypothesized stock return indicators being immaterial, when these two variables are included in the regression.

However, Griffin (2002) in his research about Fama and French's three-factor model raises a question whether it is globally applicable or this model and Fama and French (1992) results are only valid in the United States, thus country-specific. This paper explores whether time-series variation in share price returns is best characterized by country-specific or global versions of factors included in Fama and French's three-factor model (Griffin, 2002). The indicated hypothesis is tested using firm-level monthly data from January 1981 to December 1995 for four developed economies: United States, United Kingdom, Japan, and Canada, with more than 3000 non-US companies included in the research. Such a wide cross-section of firms allowed to perform a company-level analysis of the validity of size and book-to-market factors (Griffin, 2002). Study is carried out using three different versions of the Fama and French three-factor model: domestic, world, and international. All models in Griffin's (2002) paper include the market return in excess of the risk-free rate, the difference between the returns on high and low book-to-market portfolios, and the difference between the returns on small and large capitalization portfolios. The domestic version is weighted by the fraction of total market capitalization imputable to the domestic market, the international version adds these factors weighted by the fraction of total market capitalization imputable to the foreign market, while the world version uses a weighted average of country-specific components. Such approach allows to differentiate between the impact on stock returns arising from domestic and foreign indicators.

Study concludes that the domestic version of Fama and French three-factor model best explains time-series variation in individual and portfolio returns of stock prices, compared to the world and international versions of the three-factor model. It implies that performance measurement, cost of capital calculations, and risk analysis using the Fama and French model are more useful on a within-country basis (Griffin, 2002). However, none of the models are found to capture average stock returns when used as asset-pricing tools (Griffin, 2002). Although this research by Griffin (2002) focuses on different and shorter time period (1981-1995), compared to Fama and French (1992) analysis (1963-1990), according to the theory of statistics it is sufficient

share price than company's performance (earnings, cash flows) indicates, value stocks tend to have high E/P, C/P, B/M, and other similar ratios.

to yield valid and comprehensive results about universal and international applicability of Fama and French three-factor model. Therefore, conclusions about stock return determinants obtained using the Fama and French three-factor model and similar models, which are one of the most popular approaches in the literature about factors affecting changes in share prices, can be interpreted only in the specific country's context in which research was conducted.

Furthermore, quite a common approach in the literature about variables affecting changes in share prices is finding not only country-specific but even more comprehensive, industry-specific indicators of stock returns. One such example in the United States is a scientific paper written by Riley, Pearson and Trompeter (2003), who analyse traditional accounting variables', non-financial performance variables' and other information's from financial statements influence to share returns in the airline industry. Airline industry is chosen as an industry of interest because it is a mature capital-intensive industry with a regulatory structure that requires to report operating results frequently (Riley et al., 2003). Moreover, as the authors emphasize, airline industry is characterized by significant operating costs (i.e. fuel, maintenance, and labour), low margins, effective utilization of capacity, and barriers to entry due to airport limitations and little opportunities to expand. Acknowledging these features of the analysed industry is crucial in research about industry-specific factors impacting share price returns since it helps to interpret the outcome and compare research results with the ones conducted using data of other industries.

Information from financial statements is used in the study by Riley et al. (2003) since company's financial results receive serious attention in financial theory and in the literature as one of the fundamental determinants of stock price returns. Stock return is a dependant variable in this study, computed as a quarterly difference between stock prices plus dividends in a current period divided by stock price in the last period. That is one of the most popular techniques how stock returns are calculated in the literature, since it also takes into account dividend payments of companies, capturing all monetary benefits received by investors for holding certain shares. Potential financial indicators considered by Riley et al. (2003) are quarterly earnings per share (quarterly income divided by the number of outstanding shares scaled by stock price in the previous period) and quarterly abnormal earnings per share (calculated by subtracting last quarter's book value per share multiplied by a discount rate of 13% from earnings per share for the current quarter scaled by stock price in the previous period), defined by authors as variables representing financial situation and performance of the company, thus they hypothetically have a direct effect on stock prices. Besides, changes in fitted complaints, revenue load factor, market share, and available ton miles were included as non-financial probable factors impacting share returns, while growth in revenue (market share), gross profit-to-asset ratio (load factor), and assets (capacity) are used as non-financial proxies. Three types of fixed effects panel data regressions

are used to distinguish valuable determinants of stock returns, one including only financial variables, the other including only non-financial variables and a model where all variables are included. Riley et al. (2003) find that changes in earnings per share (EPS), abnormal returns, and non-financial variables are substantially associated with stock returns. However, when all variables are included in the same model, traditional financial indicators, although they significantly impact returns of share prices when included separately in the regression, do not have incremental explanatory power beyond that provided by the non-financial variables (Riley et al., 2003). Additionally, authors demonstrate that when financial statement items (assets, revenue, gross profit, etc.) are included as proxies into regression in combination with earnings per share and abnormal profit they explain approximately the same amount of the variation in returns of stock prices as non-financial metrics alone (adjusted R-Squared is 21% and 23%, respectively).

Literature about determinants of share price returns in the United States indicate that firm size and book-to-market value are important indicators of changes in stock prices, but these results are only country-specific. Also, scholar findings suggest a limited relationship between financial results and returns of shares in the United States when the effect from non-financial variables, such as market share, revenue load factor, available ton miles, and others, are considered in the regression. Therefore, only comparison with studies from other countries (conducted using domestic indicators and taking into account developing economies due to dissimilar characteristics) will allow to draw universal conclusions about determinants of stock returns, including its association with financial metrics of the company.

1.1.2. **Investigation of the share returns determinants and applied models in Asia and Pacific region**

Asia is the largest continent in the world in terms of population with approximately 4.7 billion inhabitants, according to Worldometer 2021 data, constituting around 60% of the total world's population. With so many retail economic agents, Asia's economy, formed by 48 countries, is the fastest growing and largest economy in the world in terms of real and nominal GDP, respectively (International Monetary Fund, 2021). With many newly established stock exchange markets in Asia during the second part of the 20th century and the beginning of the 21st century[2] a limited amount of historical research about stock markets in the Asian and Pacific region could be found in the scientific literature. Accordingly, in the last decade analyses about

[2] The oldest stock market in Asia and Pacific is the Bombay stock exchange in India founded in 1875, followed by the Tokyo Stock Exchange in Japan, which was founded in 1878, while most of the stock exchanges in other countries were established not before the 1950s.

Asia's stock markets[3] were of interest to many local scholars. One of the most popular topics considered by scientists in Asia is country-specific determinants of share price returns applied for different stock exchanges, which have their peculiarities, using various methods.

The simplest method to examine the relationship between two variables is correlation analysis. In analysis about returns of stock prices in Asian equity markets, most of the papers use correlation analysis as a multicollinearity[4] test in order to understand whether independent variables can be included in the regression. However, there are the same papers, which use correlation analysis as the main tool in their studies. A great example of such research approach in the examination of variables associated with share returns in Asian capital markets is a recent study conducted by Natarajan, Savikavitha and Vasani (2020).

Scholars explore the relationship between financial results and stock returns of firms listed on the Bombay Stock Exchange (BSE), India (Natarajan et al., 2020). Returns on assets (ROA)[5] the ratio was used as a representative for a firm's financial performance, while the dividend pay-out ratio served as an indicator for the company's dividend policy and financial results. According to Natarajan et al. (2020), expected returns are dependent on the information that shareholders and investors possess about the firm and factors influencing stock price in the following year, but share return uncertainty and riskiness rises from unexpected information revealed during the year, which involves financial statements and decisions on dividends. It explains why specifically ROA and dividend payout ratios are chosen as variables potentially related to stock returns in the Bombay stock exchange. Correlation analysis is performed with 5 years of historical data (2015-2019), estimating the correlation between chosen variables in each year with monthly data. Natarajan et al. (2020) find that ROA is significantly positively correlated with stock returns and the dividend payout ratio is discovered to be minimally positively correlated with changes in share prices of company's listed in Indian equity markets. This result implies that an increase in the financial performance of domestically listed Indian firms has a direct connection with its rising stock prices, while a change in dividend policy has limited relationship with stock returns. Nevertheless, findings by Natarajan et al. (2020) cannot be treated as a decisive or determining causal

[3] Stock market in Asia is the second-largest stock market by region in the world after North America, according to World Bank 2020 data, with a market capitalization of listed domestic companies being around 40 trillion dollars (approximately 40% of total market capitalization in the world).

[4] Multicollinearity is a situation in multiple regression (regression with more than one independent variable), when two regressors are highly correlated with each other damaging interpretability of coefficients in the regression as individual effects of these variables cannot be distinguished anymore.

[5] Return on assets ratio is calculated as net income of a firm divided by its assets and it shows the number of earnings a company generates for each unit of investment in assets (Palepu, Healy, Bernard, Wright, Bradbury, and Lee, 2010).

relationship for stock returns of firms listed in Bombay stock exchange, since in order to understand the extensive relationship between share returns and financial results as well as other variables more sophisticated research methods must be used.

Regression analysis is a more advanced tool that is widely used to examine the effects of one variable on another and find determinants of the dependant variable. Studies about factors influencing the development of firms' stock prices in Asia are not an exception. Even simple linear regression allows to draw valid conclusions about the usefulness of potential indicators of share returns as shown by Har and Ghafar (2015) with companies listed on the Main Board of Bursa Malaysia, Ghasempour and Ghasempour (2013) in Tehran Stock Exchange, Iran, and Al-Rjoub, Alsharari, Al-Qudah, and Alfawaerah (2013) in Amman Stock Exchange, Jordan.

Effect of firm's financial results (particularly return on assets (ROA), return on equity (ROE)[6], and return on capital employed (ROCE)[7] ratios) on share returns for plantation companies listed in the Malaysian equity market are examined by Har and Ghafar (2015) using simple linear regression and two time periods, before (2004-2006) and during (2007-2008) the global financial crisis. After employing correlation analysis scholars found expected results that accounting ratios are highly correlated. Due to the issue of multicollinearity, multiple regression analysis cannot be utilized and for that reason, Har and Ghafar (2015) use simple linear regression with panel data. Researchers discover that ROE ratio has the highest explanatory power for variation in stock returns, while ROCE and ROA ratios only in the period before the global financial crisis positively and significantly impact share returns of companies listed on the Main Board of Bursa Malaysia (Har and Ghafar, 2015).

Ghasempour and Ghasempour (2013) study the relationship between abnormal stock returns and their potential indicators in the Iranian capital market, which can be split into three categories of financial ratios (i.e., showing profitability, liquidity, and riskiness of a company). First 9 years of the 2000s are chosen as a sample time period with all firms listed in the Tehran stock exchange before 2000 included in utilized panel data (Ghasempour and Ghasempour, 2013). Authors detect that most of the fundamental financial variables (ROA, changes in ROA, changes

[6] Return on equity is used to measure company's efficiency in generating growth of earnings and is calculated as a ratio of firm's net income after tax and shareholder equity. In other words, ROE is a profitability ratio that shows how much profit a company is making by utilizing the money that has been invested by the shareholders (Har and Ghafar, 2015).

[7] Return on capital employed indicates how much profit is earned from the investments that the shareholders have made inside the company. It is estimated as a ratio between earnings before interest and the difference between total assets and total liabilities, also being employed as a scale of company's efficiency in handling their capital investments (Har and Ghafar, 2015).

in net profit margin, total asset turnover, and operational cash flow) substantially influence stock returns, whereas liquidity ratio and risk proxy variables (operating leverage, stock issuance, and the ratio of accruals) have an insufficient relationship with abnormal changes in share prices of Iranian companies.

Similarly, the relationship between stock returns of industrial sector companies listed in the Jordanian equity market and their earnings per share ratio in a form of monthly changes and levels is explored by Al-Rjoub et al. (2013). Using monthly data from 2006 to 2010, scholars determine that level of earnings per share and change in earnings per share both positively and statistically significantly affect share returns in a simple linear regression model. However, none of these variables are found to explain more than 9.9% of the variation in share returns of industrial companies from the Amman stock exchange, based on adjusted R-Squared in univariate regressions. Latter result indicates that there must be other indicators with higher explanatory power, which could be captured by expanding this study with additional potential determinants of stock returns or by using multivariate regression.

As shown by Ghasempour and Ghasempour (2013) and Al-Rjoub et al. (2013), applying univariate regression in research about factors affecting stock returns can be improved using multivariate regression. For instance, Al-Rjoub et al. (2013) observe that in the Jordanian equity market introduction of more than one representative variable of profits in linear regression allows to explain a higher portion of share returns and even inclusion of one additional variable can boost model's ability to explain changes in stock prices more than twice. Therefore, scholars in Taiwan use Fama and French factor models to explore whether Fama and French (1992) findings hold for companies listed in the stock market of Taiwan.

One of the first attempts to study determinants of stock returns in the Taiwan equity market during the 1995-1998 period with monthly data using Fama and French three- and five-factor models was made by Chen and Tu (2002). Analysis using Fama and French three-factor model reveals that size-related factor and market factor (market portfolio's excess returns) positively and statistically significantly (at 1% significance level) impact share returns, whereas factor associated with book-to-market value was observed to be significant only at 10% significance level and with a negative sign. Positive market factor's impact on stock returns is expected, as it represents it is a risk premium for market volatility, while positive size and negative book-to-market value effects mean that small firms with low book-to-market value ratio experience higher returns. However, all of these factors are detected to be not significant for the stock returns when a univariate regression model is used. Also, as the trading volume hypothesis and momentum strategy are considered essential factors for share returns, variables representing them are included in Fama and French five-factor model (Chen and Tu, 2002). Additional factors are discovered to

substantially impact stock returns in the Taiwan stock exchange, improving explained variation of stock returns from 78.5% to more than 80%. Nevertheless, Chen and Tu (2002) conclude that factor-based models are significant but not sufficient for the share returns in Taiwan since firm's risk characteristics are estimated to be more impactful to changes in stock prices, compared to Fama and French factors.

Contrasting results are found by Chen, Chen and Wu (2014), who employ standard Fama and French three-factor model for Taiwan capital market as well, but find that all factors at 1% significance level substantially affect stock returns. Only book-to-market value is observed to have a positive effect on share returns, which is an opposite result to the one obtained by Chen and Tu (2002). Additionally, these factors used in Fama and French model are discovered to have a substantial relationship with stock returns when individually included as regressors with book-to-market-related factor capturing most of the variation in share price changes (more than 40%). However, Fama and French three-factor model is calculated to explain only 45% of stock returns volatility, not improving much beyond the univariate model with book-to-market equity ratio as a sole regressor. This result raises concerns about the effectiveness of the Fama and French model to explain share price movements in the Taiwan equity market, which was found to be significant, but insufficient in Chen and Tu (2002) research as well. Almost completely opposite results about size factor, book-to-market value ratio factor, and market excess return factor obtained by the two papers examining the same Taiwan stock exchange with identical models demonstrate that the relationship between stock returns and its determinants is sensitive to the analysed time period as well. Chen and Tu (2002) analysis concerns four years of monthly data at the end of the 20th century (1995-1998), whereas Chen et al. (2014) study takes into account even nineteen years of monthly data (1991-2009).

Although Fama and French factor-based model in some instances allows to explain about 80% of stock returns variability, as shown by Chen and Tu (2002), its main drawback is that it has pre-determined independent factors that need to be included in the regression, which does not allow to capture even more substantial fraction of changes in equity market prices. Hence, the multivariate regression method with panel data and an unlimited amount of indicators is one of the most popular methods in the scientific literature to determine the relationship between share returns and potentially associated variables. Researches about capital markets in Asia and Pacific region are not an exception in term of multiple regression’s popularity in empirical studies, since this approach is utilized in equity markets all over the region. Besides, financial results and accounting metrics are among the most often studied regressors in such analysis about variables affecting the development of stock prices in Asia and Pacific region, examined in various forms and types.

An example of extensive analysis about financial and other variables' impact on equity market returns in the Pacific continent using multifactor regression and panel data can be found in scientific papers about Indonesia capital markets. Studies in Indonesia focus on companies operating in separate sectors, including banking, mining, and manufacturing sectors. For instance, a recent study conducted by Juniarta and Purbawangsa (2020) explore how economic and financial performance indicators (economic value added (EVA)[8], market value added (MVA)[9], return on investment, earning per share (EPS), and operational cash flow) impact stock returns of manufacturing companies in Indonesia stock exchange. Authors consider 7 years of data (2005-2011) and observe that only operational cash flow and EVA have a significant influence on stock returns (negative and positive, respectively). Such results obtained by Juniarta and Purbawangsa (2020) indicate that in the Indonesia equity market asset management policies to produce profits are not considered as a signal by investors (due to insignificant effect of return on investment), investment decisions are not based on net income (due to insignificant effect of EPS), investment strategy is not based on market value indicators (due to insignificant effect of MVA), but economic value creation for owners positively impacts investors' interest and trust in the company's stocks (due to significant positive effect of EVA) and company's dividend decision is made after considering all possible investment opportunities (due to significant negative effect of operating cash flow).

Similar variables are used in the study carried out by Hamidah (2015), who analysed the impact of traditional accounting ratios (EPS, EVA, ROE, and ROCE) on changes in share prices of banking sector companies listed in Indonesia stock exchange. This research focuses on 3 years (2011-2013) of data and discovers that only ROCE and EPS positively and statistically significantly impact stock returns, while effects of EVA and ROE are estimated to be insubstantial at a 5% significance level. These results are contradictory to the ones found by Juniarta and Purbawangsa (2020) since these two papers about the Indonesia stock exchange examine different time periods and economic sectors.

However, magnitudes of stock returns determination when all of the variables studied by Juniarta and Purbawangsa (2020) and Hamidah (2015) are included in the regression are only 18% and 15%, respectively, suggesting that additional potential determinants should be considered. The latest research by Hakim and Kusmanto (2020) does that by including operational cash flow,

[8] Economic value added is an economic measure, which estimates the added value produced by a firm, which minimizes the cost of capital that appears as a result of investments that have been made by this firm (Juniarta and Purbawangsa, 2020).

[9] Market value added is a cumulative measure, which demonstrates how much value is added by the company to the capital invested by investors (Juniarta and Purbawangsa, 2020).

working capital, net profit, rupiah exchange rate against US dollar, and Indonesia Bank Certificate[10] as stock returns indicators for mining companies in Indonesia during the 2009-2014 period and observing that these factors explain more than 91% of the variability in equity market returns, measured by adjusted R-squared. Only working capital is detected to have an insignificant impact on share returns with operational cash flow having a dominant effect, showing that investors pay more attention to the accessibility of the company's actual cash compared to income (Hakim and Kusmanto, 2020). Hence, scientific papers about capital markets in Indonesia revealed that traditional accounting variables alone can explain up to 20% of the variation in share returns, while their combination with macroeconomic variables raises this magnitude to more than 90%. Nevertheless, since results are found to be sensitive to an analysed time period and economic sector, the relationship between stock returns and their potential determinants should be analysed on a specific country, time period, and economic sectors basis.

The presence of country-specific results about factors affecting stock price movements in Asia and Pacific region using a multivariate linear regression model can be proven by analysis of scientific research papers conducted in countries all over the region, ranging from Australia to Jordan. Muhammad and Scrimgeour (2014) studied the relationship of accounting-based financial measures (ROA, ROE, EPS, dividend pay-out ratio, and free cash flows) and market-based financial performance metrics (P/E, MVA, market-to-book value ratio, Tobin's Q[11], and cash flow return on investment) with stock returns in Australian capital markets during the first decade of the 21st century (2001-2010). Market-based financial ratios are found to influence equity markets returns in Australia more compared to accounting measures, since all market-based variables, except for MVA, were found to be significant in a multivariate regression involving all market-based indicators, whereas only two accounting variables (ROA and dividend pay-out ratio) were substantial in a model involving all accounting-based factors (Muhammad and Scrimgeour, 2014). However, adjusted R-squared were only 14% and 18% in regressions with the market- and accounting-based determinants, respectively. Contradictorily, all accounting-based measures (ROE, ROA, and net profit margin) are observed to experience a statistically significant (at 99%

[10] Indonesia Bank Certificate is a short-term debt instrument used as the main monetary policy tool by Indonesia Central Bank. Therefore, the interest rate at which these instruments are traded is considered as a main macroeconomic interest rate in Indonesia capital markets commonly abbreviated as SBI.

[11] Tobin's Q measures the market value of a firm relative to the replacement cost of its assets and allows to determine the company's valuation adequacy. It is approximated as a sum of MVA, preferred stock price, and the number of outstanding stock divided by total assets meaning that the ratio higher than one indicates that market is overvaluing the company since firm's assets could be purchased more cheaply than the firm itself, while value lower than one demonstrates that company is undervalued (Muhammad and Scrimgeour, 2014).

level of confidence) relationship with share returns of oil and gas sector companies in Pakistan during the 2010-2014 period (Saleh, 2015). Kabajeh, Al Nuimat and Dahmash (2012) also detected that all considered financial ratios calculated from public accounting information (ROA, return on investment (ROI)[12], and ROE) positively and meaningfully impact the development of Jordanian Insurance Public Companies' equity prices. The study was conducted using data from the 2002-2007 period and multivariate regression had an adjusted R-squared equal to 46%, demonstrating that a large amount of indicators is not a necessity to achieve strong explanatory power. Interestingly, financial determinants of share price changes explain more than 80% of stock returns' variation in the Bahrain financial market, as shown by research carried out by Sharif, Purohit and Pillai (2015), which used data from 2006 to 2010. Those determinants include ROE, EPS, price-to-earnings ratio, book value per share, dividend per share, dividend yield, and debt to assets, controlling for firm size, and most of them (apart from EPS and debt to assets ratios) are discovered to substantially influence returns of shares in Bahrain stock exchange. Sharif et al. (2015) study concerning Bahrain capital market obtained 4 times bigger adjusted R-squared value compared to Muhammad and Scrimgeour (2014), although similar accounting-based regressors, time period of interest and methodology was used, indicating that relationship between financial results and stock returns is individual in each country.

Alternative methods using panel data and multivariate regression in analysis about stock returns indicators are employed in Asia as well, in order to include a large number of potential indicators in the research or to more precisely determine the relationship between a particular factor and equity market return. A latter approach is applied in a study about Iran financial market performed by Saeidi and Okhli (2012) to examine the effect of ROA ratio on share price returns using data from 2001-2010 period (similarly as in Muhammad and Scrimgeour (2014) paper about Australia capital market), but by including company's characteristics as control variables. Although the methodology is non-identical, ROA is also observed to have a significant influence on share returns as in other reviewed literature about financial markets in Asia with an impressive 68% of dependant variable changes based on independent variable changes in Tehran stock exchange, suggesting that it is one of the fundamental determinants of stock returns (Saeidi and Okhli, 2012). Whereas Das and Pattanayak (2009) in their study about the India capital market during the 2001-2005 period inspect the impact of 16 various variables on stock price movements, condensing them to six key factors, which are analysed using multivariate regression. Research finds the favourable effect of four factors (earning power, ROI, valuation, and growth) supporting

[12] Return on investment (ROI) measures company's invested capital utilization efficiency and is calculated as a ratio between net profit after tax divided and the total paid-in capital. It expresses firm's ability to generate a return based on using and managing the investments by the shareholders (Kabajeh, Al Nuimat and Dahmash, 2012)

the importance of financial-based factors, while volatility and risk factors detected to have a negative impact on stock returns. One of the reasons for adjusted R-squared being only slightly above 22% in Das and Pattanayak (2009) could be the fact that ROA is not one of the considered fundamental share returns determinants potentially capturing most of the unexplained variation in equity price movements.

An exhaustive overview of scientific papers about financial markets in Asia and Pacific region revealed different statistical methods that could be used to observe the relationship between various economic and financial variables and stock returns as well as best-performing fundamental determinants. Particularly, described studies in Asia and Pacific region demonstrated that univariate regressions have low determination coefficients independently of the chosen independent variables, implying that such model can be utilized only for individual effects comparison, but for extensive research about share price returns multivariate regression must be employed with correlation analysis performed beforehand to avoid possible instances of multicollinearity. However, amount of indicators included in the regression was proven not to guarantee a high regression's explanatory power, since the choice of included regressors is a key aspect. Critical factors impacting stock price movements are detected to be country, industry, and time period specific with return on assets (ROA) being the only variable, which is substantially influencing the development of share prices in most of the reviewed studies about Asia and Pacific region. Moreover, the relationship between financial results and share returns was discovered to be dependent on the chosen representative variables and typically not solely capturing all of the stock returns variability.

1.1.3. **Methodology selection and effect of accounting information on share prices in Africa exchange market analyses**

Africa is the continent with the fastest-growing population in the world with approximately 2% annual population growth rate, according to the World Bank data. As of 2021, Africa accounted for around 17% of the world's population and made up 20% of the earth’s landmass. However, despite these facts the Dark Continent created less than 3% of global GDP, being the continent with one of the smallest economies and based on the World Bank evaluations market capitalization of listed domestic companies in Africa were worth less than 6% of total market capitalization in the world. Africa is considered to be in a deep financial and economic stagnation for years due to its difficult past. Nevertheless, scholars are interested in the main drivers of share price fluctuations in Africa's stock exchanges and examine them applying various modelling and estimation methods, including multivariate regression with fixed and random effects, together

with ordinary least squares (OLS) and pooled ordinary least squares (POLS) estimation and using panel data.

Comprehensive research about determinants of share prices was carried out by Aveh and Awunyo-Vitor (2017) who inspect the impact of firm-specific accounting information on stock prices of all firms listed on the Ghana Stock Exchange. Study utilizes data from 2008 to 2014, since only in 2007 Ghana adopted the International Financial Reporting Standards (IFRS)[13] providing research opportunities with improved quality of financial statements (Aveh and Awunyo-Vitor, 2017). Scholars considered OLS, POLS, fixed and random effect models as feasible approaches to detect factors affecting stock price movements. In the fixed-effects model time or/and group effects are represented with a dummy variable, allowing to control for omitted variable bias caused by constant but unobserved heterogeneity, whereas the random-effects model takes into account individual specific effects (Aveh and Awunyo-Vitor, 2017). Authors distinguish the model which should be applied in their research using statistical tests. The Hausman test[14] showed that the random-effects model is preferred over the fixed effects model, while the Breusch–Pagan Lagrange multiplier test[15] revealed that there is no substantial difference across firms in the Ghana stock exchange and POLS regression should be used. Dividend per share, dividend yield, EPS, ROE, book value per share, leverage, and size of the firm are used as financial-based indicators by Aveh and Awunyo-Vitor (2017) observing that they explain around 75% of the variation in share prices and experience a substantial relationship (apart from dividend per share and firm's leverage variables) with stock prices of companies in Ghana financial market. Results infer that accounting information is crucial for investors' actions in the Ghana stock exchange, while company's dividend decision is not essential.

Contrasting results about the significance of return on assets metric as a determinant of stock returns is detected in capital markets of Africa, which was found to be one of the key factors impacting share price changes in Asia and Pacific region. On the one hand, in recent research by Musah and Aryeetey (2021) focusing on companies listed in the Ghana stock exchange during the 2009-2018 period ROA was found not to have a substantial impact on share prices. The scientific paper included macroeconomic and firm-specific factors as well as book ratios (10 variables in

[13] International Financial Reporting Standards (IFRS) are a set of accounting rules that define how financial statements of companies should be created making them transparent, consistent, and comparable between different countries.

[14] The Hausman test is used to determine whether the unique errors are correlated with the regressors. The null hypothesis of Hausman test is that there is no correlation and random effects model should be used (Aveh and Awunyo-Vitor, 2017).

[15] Breusch–Pagan Lagrange multiplier test is employed to inspect whether homoscedasticity assumption holds (null hypothesis) helping to decide between POLS and random-effects models in panel data regressions.

total) in the regression analysis, finding dividend per share (contradicting Aveh and Awunyo-Vitor (2017) results), firm size, EPS, economic growth, and financial institutions dummy variable as significant determinants of stock prices. On the other hand, Uwuigbe, Olusegun and Godswill (2012) observe that ROA together with dividend pay-out ratio and firm's leverage, experience a significant relationship with share prices in Nigeria stock exchange using data from 2006 to 2010. Regression models in both Musah and Aryeetey (2021) and Uwuigbe et al. (2012) papers explain a majority of dependent variable's variation (79% and 91%, respectively), suggesting that missing variables have little impact on changes in equity prices in the model where ROA is included as a regressor.

Financial results were noticed to be essential determinants of share prices, explaining most of its changes, in analysed studies about different financial markets in Africa, which was found to be not always true for metrics related to the firm's dividend policies. Moreover, high explanatory power of applied models was found in studies both with and without ROA as one of the potential indicators, as long as enough financial metrics were considered in the regression. Instances of opposing outcomes for the same variable were revealed in studies concerning dissimilar time periods and countries in Africa.

1.1.4. **Cross-country studies and fundamental variables in European financial markets**

With the first stock exchange in the world being established in Amsterdam, The Netherlands, at the beginning of the 17th century, equity markets have a rich history in Europe. It was a domestic Dutch capital market for almost 400 years, until 2000 when Amsterdam Stock Exchange was merged with exchanges based in France and Belgium, creating a pan-European stock exchange called Euronext. Nowadays it is the largest equity market in Europe (4.9 trillion US dollars market capitalization as of 2021) and symbolizes strong interconnectedness between European countries in financial markets. Moreover, Europe is a continent in which most of the countries (27 out of 44) are associated via economic and political union (European Union), while 19 countries also share the same monetary policy. Therefore, numerous studies about factors affecting share price movements in Europe focus on multiple countries, comparing observations and derived conclusions, since limited economic differences between countries indicate that similar research results should be obtained.

One of the commonly employed tools to identify determinants of share prices and their changes in analysis concerning multiple countries is a two-step error correction models, which separate long-run stock price values from short-run deviations examining each part individually. The first step of this approach focuses on evaluation of the relationship between the long-run

"equilibrium" value of the share prices and its fundamental variables allowing to define base equity market price and its long-run trend. Models of the second step are concentrating on short-run changes of stock prices around their fundamental (long-run) value, which might be caused by fluctuations in key determinants of share prices or by non-fundamental factors affecting them in the short-run. Bondt (2008) applies this method to obtain international evidence of share price determinants using information from twelve countries, eight of which are European (Austria, Belgium, Denmark, France, Germany, Netherlands, United Kingdom, and Switzerland). Paper includes 27 years of monthly data in the effective sample (1978-2005) and considers risk-free rate, earnings, and a long-run equity risk premium[16] as fundamental determinants of share prices based on present value theory and preceding literature. Long-run regression revealed that chosen core variables are substantially influencing stock prices in all countries at a 10% significance level, apart from Austria where the risk-free rate was found to be insignificant. Together with the fact that adjusted R-squared were estimated to range from 35% to 69% in eight European countries, these results prove that long-run fundamental factors of share prices in European capital markets were selected accurately. In the second step of this method, Bondt (2008) adds commodity price index, exchange rate, seasonality, momentum effects[17], and lagged monthly change in share prices as variables potentially affecting short-run equity price dynamics. Exchange rate and commodity price index were found to be substantial in all countries (only in Austria commodities price index was insignificant), whereas momentum effects, lagged return and seasonality were significant factors only in some specific countries. Introduction of short-run stock price indicators increased model's explanatory power up to six percentage points in European countries. Research by Bondt (2008) revealed that similar results about equity price determinants are obtained in European countries using the same methodology and time period of interest.

Furthermore, Harasty and Roulet (2000) utilize the two-step error correction model by including four additional European countries (Italy, Norway, Spain, and Sweden) to the ones considered by Bondt (2008) and using monthly data from 1988-1998 time period. Scholars select long-term interest rates and EPS at the index level as fundamental variables justifying that with identified cointegrating relationships in all countries. Exchange rate, different kinds of spreads, short rates, and the January effect (dummy variable, which equals 1 in January and 0 in other

[16] A long-run equity risk premium is included in the regression as a proxy for the time-varying equity risk premium and is approximated as the one-period lagged five-year rolling earnings yield premium (spread between the reported earnings yields and the real 10-year government bond yield) (Bondt, 2008).

[17] Momentum effects are represented by a dummy variable, which is equal to one when the one-period lagged share price is higher than both the three- and five-month moving averages of the share price and takes the value zero otherwise (Bondt, 2008).

months) are considered as factors explaining short-term changes in share prices. Harasty and Roulet (2000) observed that from 27% to 47% of stock price variation in analysed biggest European equity markets are explained by a model with additional short-run variables substantiating similarities of results between countries in Europe.

However, this similarity of results about indicators influencing stock price movements in European financial markets does not imply that conclusions from analysis about specific country hold in all other European countries as even in reviewed papers concerning research about multiple countries in Europe (Bondt, 2008; Harasty and Roulet, 2000) several discrepancies were found. An example of cross-country differences can be detected even in scientific papers focusing on countries that have almost identical economic and financial situations, as it was shown by Pritchard (2002) in her study about Baltic (Lithuania, Latvia, and Estonia) stock markets. The association between accounting information and equity price returns over five years (1995-2000) was examined in this paper. Accounting earnings-to-price ratio (E/P) was chosen as a single representative indicator of company's financial performance by Pitchard (2002) and its effect on share returns in Baltics was investigated using a univariate cross-section regression model with fixed effects (controlling for firm-specific characteristics) and information from 99 companies. The relationship between earnings and equity price returns was observed to be substantially different between the three Baltic countries since Estonia was evaluated to have the highest value relevance, while Lithuania showed the weakest. Author explains that the efficiency of stock markets and the development of accounting systems and standards are the reasons behind disparities between accounting information influence on stock prices since research was conducted before Baltic countries joined the European Union and Eurozone. Moreover, the inclusion of leading-period stock returns into regression revealed that it positively impacts calculated E/P coefficient and adjusted R-Squared value in three Baltic countries, indicating that share prices lead earnings and information set reflected in stock prices includes information about future changes of accounting earnings (Pitchard, 2002).

Maybe due to outcomes of Pitchard (2002) study or due to relatively small stock exchange and thin trading, following researches about Lithuania equity market focus mainly on macroeconomic variables as fundamental determinants of share prices and their returns applying dissimilar scientific methods with limited attention to firm's financial metrics. Such tendency is not affected even by Bagdonas and Balsytė (2005) finding that price-to-earnings (P/E) ratio explains almost 93% of Lithuania stock price index variation in a univariate regression model. Main macroeconomic variables in Lithuania (gross domestic product (GDP), consumer price index (CPI), money supply, foreign direct investment (FDI), and interbank offered rate) were estimated to explain less than half of the asset prices volatility using autoregressive distributed lag

model (ARDL) but were proven to experience a long-run causal relationship with assets in Lithuania (Jurkšas and Paškevičius, 2017). In addition, analysis that utilizes impulse response function (IRF) approach demonstrates that most of the macroeconomic variables are substantially impacting share prices in Lithuania with GDP and money supply having a positive impact, while unemployment rate, exchange rate, and short-term interest rates have a negative impact (Pilinkus and Boguslauskas, 2009). CPI is observed to have no significant impact. Almost identical results were attained by applying the exponential general autoregressive conditional heteroskedastic (EGARCH) model for Lithuania's capital market. Besides significant macroeconomic indicators of equity market prices found by Pilinkus and Boguslauskas (2009), stock market indexes in the U.S. and Germany, as well as government deficit to GDP ratio and euro area government bond yield were discovered to be important determinants of stock prices in Lithuania (Hsing, 2011). Lastly, some macroeconomic variables (net export, FDI, and GDP deflator) were recognized as leading indicators for share returns in Lithuania, while other macroeconomic variables (GDP, construction volume index, and material investment) are led by Lithuania stock price index (Pilinkus, 2009).

Studies about share price determinants in European countries revealed that similar results are obtained in different equity markets as shown by cross-country analysis, but they are not identical due to country-specific factors and circumstances affecting the domestic stock market and listed companies. In Lithuania contrasting results about the relationship between the financial results and share returns were discovered, whereas most of the scientific papers focus on macroeconomic variables as fundamental determinants of stock price returns.

Literature analysis involving scientific studies conducted all over the globe revealed that factors impacting stock returns are significantly different in various markets and even within countries. The main results of reviewed research papers are summarized in Table 1 demonstrating cross-country disparities.

1.2. **Predictability of share returns using financial results**

Understanding the fundamental variables that affect changes in share prices is of great importance to shareholders, investors, and scholars, but a possibility to predict future equity market price movements and returns opens an opportunity for related counterparties to make certain financial decisions based on verified information about the future. In the case of share returns predictability, investors can decide on their portfolio structure by taking into account future returns, while stockholder who fails to do so may suffer significant losses. Moreover, forecasting of stock returns permits effective macroeconomic and financial risk management due to known and statistically proven anticipated outcomes. For that reason, out-of-sample performance of various models representing the determinants structure of share returns is a widely debated topic

Table 1

Overview of literature about factors determining share returns

Authors (Year)	Identified factors	Method(s)	Country
North and South America			
Fama and French (1992)	Firm's size, B/M	Multiple regression	USA
Fama and French (1998)	B/M, E/P, C/P, dividend yield	Multiple regression	USA
Riley et al. (2003)	EPS, abnormal returns, fitted complaints, revenue load factor, market share, available ton miles	Simple linear and multiple regressions	USA
Asia and Pacific			
Chen and Tu (2002)	Firm's size, excess returns, B/M, momentum, trading volume factors	Fama and French three- and five-factor models	Taiwan
Das and Pattanayak (2009)	ROI, earning power factor, valuation factor, growth factor	Multiple regression with factor analysis	India
Saeidi and Okhli (2012)	ROA	Multiple regression with control variables	Iran
Kabajeh et al. (2012)	ROA, ROI, ROE	Multiple regression	Jordan
Al-Rjoub et al. (2013)	EPS, change in EPS	Simple linear and multiple regression	Jordan
Ghasempour and Ghasempour (2013)	ROA, net profit margin, total asset turnover, operational cash flow	Simple linear and multiple regression	Iran
Chen et al. (2014)	B/M, firm's size, market excess returns	Fama and French three-factor model	Taiwan
Muhammad and Scrimgeour (2014)	B/M, P/E, Tobin's Q, cash flow return on investment, ROA, dividend pay-out ratio	Multiple regression	Australia
Har and Ghafar (2015)	ROA, ROE, ROCE	Simple linear regression	Malaysia
Sharif et al. (2015)	ROE, P/E, book value per share, dividend per share, dividend yield	Multiple regression with control variables	Bahrain
Saleh (2015)	ROA, ROE, net profit margin	Multiple regression	Pakistan
Hamidah (2015)	ROCE, EPS	Multiple regression	Indonesia
Juniarta and Purbawangsa (2020)	Operational cash flow, EVA	Multiple regression	Indonesia
Hakim and Kusmanto (2020)	Operational cash flow, net profit, exchange rate, interest rate	Multiple regression	Indonesia
Natarajan et al. (2020)	ROA	Correlation	India
Africa			
Uwuigbe et al. (2012)	ROA, dividend pay-out ratio, firm's leverage	Multiple regression	Nigeria
Aveh and Awunyo-Vitor (2017)	ROE, EPS, dividend yield, book value per share, firm's size	Multiple regression with fixed/random effects and OLS/POLS estimation	Ghana
Musah and Aryeetey (2021)	Dividend per share, firm's size, EPS, economic growth	Multiple regression	Ghana
Europe			
Harasty and Roulet (2000)	EPS, interest rates, exchange rate, interest rate spreads	Two-step error correction model	Multiple
Pritchard (2002)	E/P	Univariate regression with fixed effects and control variables	Baltics
Bagdonas and Balsytė (2005)	P/E	Simple linear regression	Lithuania
Bondt (2008)	Earnings, interest rate, commodity index, risk premium, exchange rate	Two-step error correction model	Multiple
Pilinkus and Boguslauskas (2009)	GDP, money supply, exchange, unemployment, and interest rate	IRF	Lithuania
Pilinkus (2009)	Net export, FDI, GDP deflator	Granger-causality test	Lithuania
Hsing (2011)	Government deficit, bond yield	EGARCH	Lithuania
Jurkšas and Paškevičius (2017)	GDP, CPI, money supply, FDI, interest rates	ARDL	Lithuania

Source: prepared by the author based on the research

in the forecasting literature, where firm's financial information indicators are considered as one of the main potential predictors. In share returns predictability analyses same metrics indicating financial performance of a company (described throughout Section 1.1) are utilized. Therefore, this part focuses mainly on forecasting methods applied in the studies about forecasting of stock price changes.

Linear models are the most commonly used approach in the studies about equity market returns forecasting since although no particular model could be applied uniformly to all markets linear and non-linear models are found to experience higher forecasting accuracy, compared to artificial intelligence and frequency domain models (Mallikarjuna and Rao, 2019). Predictive regressions in a form of simple and multiple models using panel data are applied in the Malaysia stock exchange by Kheradyar, Ibrahim and Nor (2011), who employ the generalized least squares (GLS) technique to estimate regression coefficients since it helps to solve the heteroskedasticity and residuals non-normality issues. Forecasting accuracy of well-known financial ratios (earnings yield, dividend yield, and book-to-market ratio) is tested in predicting returns of shares during the 2000-2009 period with monthly data. The predictive power of financial ratios chosen by Kheradyar et al. (2011) is proven to be useful in the forecasting of stock returns even by Fama and French (1992, 1995). These financial metrics are considered to be good predictors mostly because they capture information about the risk of a company and each ratio has share price in the denominator, so when stocks are overpriced, financial ratios have lower value and forecast low share returns (Kheradyar et al., 2011). Empirical analysis conducted by Kheradyar et al. (2011) confirmed the theoretically expected result that financial ratios are useful in share returns forecasting, as book-to-market ratio was found to have the highest predictive power out of three considered financial metrics.

Correspondingly, forecasting ability of the same financial ratios as in Kheradyar et al. (2011) is examined by Lewellen (2004) in the United States capital market throughout the 1946–2000 period for dividend yield and throughout 1963–2000 period for earnings-price ratio and book-to-market ratio. In the United States, all considered financial ratios were detected to be beneficial in predictions of future market returns, but contrary to research about Malaysia stock exchange, dividend yield was observed to have the most reliable evidence for forecasting power. Such cross-country differences in the patterns of the share price return predictability are also found by Schrimpf (2010), who carries out equity market returns predictability analysis in five major economies (United States, France, Germany, United Kingdom, and Japan). Scholar adds interest rate related variables (term spread, short-term interest rate, and long-term government bond yield) and macroeconomic variables (inflation, industrial production, and output gap) to valuation ratios (dividend yield and earnings yield) analysed by Lewellen (2004) and Kheradyar et al. (2011).

Interest rate-related factors are discovered to be among the most important predictive variables in the study by Schrimpf (2010), while forecasting performance of valuation ratios is perceived to be rather poor, but contrasting across countries. Predictability of equity market returns is observed to be neither a uniform nor a universal feature of international capital markets (Schrimpf, 2010). Furthermore, a simple model developed by Bondt (2008), which includes earnings as one of the fundamental determinants of stocks prices tends to internationally outperform the random walk model in the out-of-sample one period-ahead forecasting exercise, suggesting that financial results contain useful information about future share returns.

In Lithuania, the effectiveness of technical and fundamental analyses using company's financial ratios in the stock price forecasting exercise is tested by Dzikevičius and Šaranda (2011). Basic methods (covariance and correlation) are employed as the main analytical tools and 4 years of historical data (2007-2010) is chosen as a sample period in Dzikevičius and Šaranda (2011) research. The forecasting power of financial ratios is examined extensively since twenty financial metrics are included in the analysis. However, the three fundamental ratios inspected by Kheradyar et al. (2011) and Lewellen (2004) are not among them. Authors concluded that firm's financial information helps to predict future share price movements and fundamental analysis can be used in the Lithuania stock market, but it should be enriched with sector-specific and macroeconomic variables. Nevertheless, due to the over-simplified methodology of financial ratios predictive power evaluation in Dzikevičius and Šaranda (2011) paper validity of their results is uncertain, creating an opportunity for expanded research about the ability of financial metrics to predict share returns in Lithuania capital market.

A common approach to improve the predictability of dependent variable in forecasting literature is a combination of individually forecasted values, which allow to obtain more robust and reliable forecasts (Timmermann, 2006). Resistance to measurement errors and misspecification biases, adaptation to structural breaks, unique underlying loss function, and diversification are the main reasons listed by Timmermann (2006) indicating the usefulness of forecast combinations in prediction exercise. Theoretical effectiveness of combination forecasts are found to be valid in empirical research about equity returns forecasting with financial ratios since Kheradyar et al. (2011) conclude that combination of predictions made by individual financial metrics enhances the predictability of stock returns in Malaysia capital market and Schrimpf (2009) observes that averaged out-of-sample forecasts tend to outperform individual forecasts in multiple countries. Therefore, combination forecasts using company's financial results, independently of employed combining technique, are yielding the most accurate forecasts of share returns, based on the scientific literature.

2. ECONOMETRIC FRAMEWORK

This section covers the econometric methodology that is employed in the research to determine the relationship between firm's financial results and share returns in the Vilnius stock exchange, choosing variables of interest and applied models based on the extensive analysis of scientific literature. Eight indicators of firm's financial performance are selected for this study subject to their popularity in academic research papers reviewed in Section 1. Moreover, model selection process and applied methodology is determined in consonance with the examined publications.

Firstly, factors derived from companies' public financial information, which potentially impact changes in stock prices, are described, justifying their relevance for the firm and its operational performance, as well as the necessity of these factors to be considered as plausible determinants of equity price returns. Since experience from previous studies suggest that the relationship between financial indicators and movements in share prices can potentially be seen both within-sample and out-of-sample, selected accounting metrics are tested not only as possible determinants but also as likely predictors of stock price returns. To examine the significance of influence that specified independent variables have on the development of share returns, simple linear regression models and multiple regression models (if possible after correlation analysis) are utilized in this research, while forecasting abilities of probable predictors is evaluated based on a pseudo-out-of-sample exercise and subsequently by combination forecasts, which are defined at the end of this section.

Analysis conducted in this study includes all of the companies listed in the Vilnius stock exchange starting from January 2009, up until December 2021 and quarterly data on firm's share prices and their accounting information is obtained directly from the NASDAQ Vilnius database. Such time period was chosen due to the fact that Lithuania joined the European Union only on May 1, 2004, which not only improved economic and financial stability in the country but also brought additional funding possibilities for Lithuanian companies and restructured financial reporting framework in Lithuania (IFRS standards for financial statements of listed Lithuanian companies became effective from the end of 2005 financial reports). Moreover, start of global financial crisis is excluded in order to avoid anomalies seen in the financial data during that period. Based on these historical data requirements, a total of 10 public companies qualified to the sample of this research with the reasoning that firms listed for a longer period of time may yield better insight for the tested hypotheses. Therefore, a chosen sample size of used panel data is sufficient

to apply various econometric methods and to make statistical inferences about the relationship between financial results and stock returns in the Lithuania capital market.

2.1. **Variables employed in the analysis of share returns**

All of the models employed in this analysis exercise quarterly returns of company's shares as a dependent variable of the regression, which demonstrates how firm's equity market prices changed during the quarter, taking into account the total amount of dividends received by investors during the period. The share return variable allows to capture shareholder's overall benefit received from acquired stock throughout the quarter and is a good measure of investment's general performance since the two main income sources from the share are appreciation of its market value and the amount of paid dividends. Quarterly *share returns* are calculated by the following formula:

$$R_{it} = \frac{P_{it} - P_{i(t-1)} + D_{it}}{P_{i(t-1)}} \quad (1)$$

where R_{it} is a share return of company i at time t, while P_{it} and D_{it} are a corresponding price of share and dividend of share, respectively. This estimation method of stock returns is very popular in scientific papers which examine factors impacting equity market returns, such as Har and Ghafar (2015), Riley et al. (2003), and many other mentioned in the literature review. It provides share returns as a fraction of share price in the previous quarter.

Financial results of a company can be represented in various forms and using different financial metrics. Accounting information coming mostly from financial statements is one of the main sources of data that gives an insight about firm's financial performance and is utilized by scholars (e.g. Aveh and Awunyo-Vitor, 2017; Saeidi and Okhli, 2012; Kabajeh et al., 2012; etc.) in their researches about determinants of stock returns. Eight financial ratios and accounting values are tested as potential indicators and predictors of share returns in Lithuania determined from reviewed scientific papers and based on data availability: ROA, ROE, EPS, operating cash flow, P/E, financial leverage, net profit margin, and total asset turnover. A relatively large amount of independent variables was selected because factors influencing equity returns in capital markets were discovered to be specific for the analysed country and time period (Schrimpf, 2010; Pitchard, 2002), hence it is not possible to define a particular set of possible predictors and determinants of share returns in advance.

Return on assets (ROA) is a financial ratio, which indicates firm's profitability, showing company's efficiency in profit generation from its assets. Higher ROA ratio means that management is able to utilize capital, which is invested in assets, better compared to companies experiencing lower ROA ratio. It is estimated by dividing company's profit (net income) by its economic resources (total assets):

$$ROA = \frac{Net\ income}{Total\ assets} \quad (2)$$

Return on equity (ROE) is a profitability ratio as well (similarly to ROA), only that it demonstrates company's abilities to make profit from shareholders' equity investments. ROE ratio provides insight into management's expertise in turning equity funding to business growth and as a result to growth in earnings. It is an important metric for both current and potential investors because it shows return for their invested money and is calculated as the ratio between the net income and total shareholders' equity:

$$ROE = \frac{Net\ income}{Total\ shareholders' equity} \quad (3)$$

Earnings per share (EPS) is another indicator of firm's profitability, reflecting company's capability to make profits for common shareholders and commonly used for comparison of listed companies' performance. It is a measure of corporate value, which is estimated as a firm's net profit divided by the number of outstanding common shares:

$$EPS = \frac{Net\ income - Preferred\ dividends}{Number\ of\ outstanding\ common\ shares} \quad (4)$$

Operating cash flow is a metric, which determines the amount of cash generated by a company via its regular business activities. This measure demonstrates firm's abilities to originate enough cash to sustain and expand its operating activities, without a need for external financing. Operating cash flow value is coming directly from company's cash flow statement and is an important factor for investors because it displays firm's financial situation and possibilities to grow in the future.

Price-to-earnings (P/E) ratio is one of the most popular and familiar criteria for stock valuation in financial literature and analytics, used for comparison between different companies, markets, and periods. It reveals the relation between company's share price and sum of trailing twelve months (TTM) EPS, showing investors what they should pay for a unit of firm's earnings. P/E ratio is measured by the following equation:

$$P/E = \frac{Share\ price}{EPS\ (TTM)} \quad (5)$$

Financial leverage measures the extent to which company's assets are financed by its debt. Higher financial leverage means that the main firm's funding source is debt and it is deemed to be riskier due to the obligation to pay interest expenses. However, if funds received from debt are invested properly and generate higher returns than costs of financing, increased financial leverage might indicate potential company's growth. Financial leverage is estimated as total assets divided by total shareholders' equity:

$$Financial\ leverage = \frac{Total\ assets}{Total\ shareholders' equity} \quad (6)$$

Net profit margin is a financial ratio, which demonstrates how much profit company is making relative to its revenue. It displays what fraction of each unit in revenue is turned into profit, hence indicating the adequacy of costs structure that firm encounters. Net profit margin is a crucial metric in the financial analysis since it illustrates company's financial condition. It is calculated by the following equation:

$$Net\ profit\ margin = \frac{Net\ income}{Total\ revenue} \quad (7)$$

Total asset turnover ratio discloses company's asset utilization efficiency and abilities to originate sales, showing how many times company turns over its assets during the period. It represents the amount of revenue generated by a company during trailing twelve months (TTM) per one unit of its assets (average of total assets current period and total assets at the same quarter last year) and high total asset turnover ratio indicates that company is using its assets efficiently, helping investors to compare similar firms:

$$Total\ asset\ turnover = \frac{Total\ revenue\ (TTM)}{Total\ assets} \quad (8)$$

In order to avoid possibilities of obtaining invalid results due to data denomination in different currencies (on January 1, 2015, Lithuania adopted euro as primary currency instead of the previously used national currency – Lithuanian litas) all the values until the beginning of 2015 are divided by 3.4528, which was a pegged exchange rate between Lithuanian litas and euro from 2002, up until 2015.

2.2. **Utilized approach to examine determinants and predictors of share returns**

A starting point in the analysis about the relationship between the aforementioned financial metrics and returns on shares is the application of a simple linear regression model. It allows to see the isolated impact that tested variables have on stock returns, as well as their individual explanatory power. In case of high multicollinearity between employed indicators, regression with multiple independent variables cannot be used to determine discrete effects of potential determinants, since a change in one regressor would automatically result in a change of another regressor due to high correlation between them, eliminating the possibility to detect the individual impact of used factors, as it was demonstrated by Har and Ghafar (2015). Therefore, univariate regression becomes the only solution how the influence of possible indicators can be examined if they experience high correlation since it is not subject to multicollinearity as only one exogenous variable is used in the model and obtained results are easily interpretable. Although it is one of the

most basic econometric techniques, univariate regression is popular in scientific studies, employed by Ghasempour and Ghasempour (2013) in the Iran capital market, Har and Ghafar (2015) in Malaysia Stock Exchange and by Al-Rjoub et al. (2013) in Jordan equity markets, to name a few that were analysed in this paper. Equation for applied simple linear regression in the analysis of financial results effect on equity returns is shown below:

$$R_{it} = \alpha_i + \beta_1 X_{it} + \varepsilon_{it} \tag{10}$$

where $X_{it} = \{$*ROA, ROE, EPS, operating cash flow, P/E, financial leverage, net profit margin, total asset turnover, dividend per share*$\}$ is a set of potential determinants of share returns, β_1 is an unknown individual coefficient of the regression, α_i are an entity-specific intercepts, which are capturing heterogeneities across entities, ε_{it} is an error term, i is a cross-sectional dimension of the panel data, ranging from 1 to 10 (number of analysed companies) and t represents time dimension, ranging from 1 to 64 (number of time periods in the sample). "Financial metrics significantly impact stock returns in simple linear regression" is the main hypothesis tested by the univariate regression model.

After simple linear regression analysis, correlation analysis is performed in order to investigate the relationship between chosen explanatory variables, testing whether they are excessively statistically interrelated and definite effect of each financial metric could be distinguished using a multiple regression model. A correlation coefficient of 70% is selected as a benchmark point diagnosing a high correlation between the two factors. In case presumption that "there is no multicollinearity between chosen independent variables" is discovered to be incorrect, multivariate regression is still employed, since high dependence between two or more regressors does not impact estimated fit of the model and accuracy of predictions made using it. However, in case of detected multicollinearity, additional multivariate regressions are employed excluding one of the highly correlated variables in order to see their segregated effect.

Multiple regression model is a useful method in the study about determinants of share returns because it enables to better specify the model since it is very unlikely that changes in stock prices depend only on one variable and exclusion of explanatory variables, which are correlated with remaining regressor raises a problem of omitted-variable bias (OLS estimators become biased and inconsistent). Moreover, multivariate regression allows to examine the hypotheses that "certain measures of financial results substantially impact returns of shares" and that "financial results explain most of the variation in share returns". Following linear regression with several independent variables is applied in this research, after performing Hausman test (to choose between a fixed-effect or a random-effect model) and Breusch–Pagan Lagrange multiplier (LM)

test (to select between the pooled OLS and random effect models, as well as between fixed effect and random effect models):

$$R_{it} = \alpha_i + \sum_{j=1}^{9} \beta_j X_{jit} + \varepsilon_{it} \quad (11)$$

where β_j (j=1,...,9) are unknown coefficients estimated for each financial metric included in the regression (nine explanatory variables in total) and X_{jit} (i=1,…,10) (t=1,…,64) is representing each explanatory variable selected from firms accounting information, while other variables stay the same as in univariate regression model. In order to make sure that the applied model is valid and results are reliable subsequent statistical tests are exercised additionally: Levin-Lin-Chu test (assessing stationarity of used variables in panel data), Durbin-Watson test (examining autocorrelation in the time dimension), and Breusch–Pagan test for the selected model (determining heteroscedasticity in a variance of error term).

If in Levin-Lin-Chu unit-root test null hypothesis of a unit root for one of the individual series in a panel data is failed to reject, first difference of that variable is used in further analysis (testing also whether first difference has a unit-root). While results of Durbin-Watson test and Breusch–Pagan test indicate whether usual standard deviations can be applied in the econometric analysis techniques. In case heteroskedasticity is detected with Breusch–Pagan test, heteroskedasticity robust standard errors are exploited in the research, whereas if in addition no serial correlation assumption is denied by Durbin-Watson test, heteroskedasticity and autocorrelation consistent standard errors are employed when estimating significance of econometric models' coefficients.

Predictability is another aspect how financial results can be related to share returns, which is more powerful than plain influence since it allows to forecast future movements of stock prices and base strategic as well as investment decisions on this information for the counterparties involved. Forecasting abilities of financial metrics are tested in this study by investigating whether "forecasts with individual financial ratios outperform benchmark forecasts based on historical share return data" and whether "combination of individual forecasts made using company's financial information improves predictive power of the model", using one-step-ahead forecasts and lag length of regressors set at one period. Forecasts with the short horizon and limited impact of historical data are chosen because stock prices rapidly adapt to new information, meaning that it would be naïve to expect that financial results help to predict share returns more than one quarter in the future and that data older than one quarter in the past is helpful in equity returns forecasting exercise.

Linear models are employed, since they are found to experience higher forecasting accuracy, compared to artificial intelligence and frequency domain models in the literature

(Mallikarjuna and Rao, 2019) and are the most commonly used approach in the studies about share returns forecasting (Kheradyar, Ibrahim and Nor, 2011; Lewellen, 2004; Bondt, 2008; Schrimpf, 2010). Specifically, autoregressive (AR) and autoregressive distributed lag (ARDL) models are often used in the forecasting exercise, because of the convenience in an analysis and comparison of each potential predictor's forecasting abilities, e.g Stock and Watson (1999, 2003).

A starting point in the forecasting analysis is the regression of future share returns on its current and past values using an AR model. Since technical analysis of equity prices is a widely used trading discipline, which utilizes past values and trends of stock prices in its evaluations, it is expected that the AR model will yield reasonably accurate predictions. For that reason, the AR model (displayed in Equation 12) is employed in the forecasting literature and in this research as a benchmark model against which outcomes of other models will be compared.

$$R_{it+1} = \alpha + \sum_{k=0}^{m} \beta_k R_{it-k} + \varepsilon_{it+1} \quad (12)$$

Here m is a length determined by based on Bayesian Information Criterion (BIC), allowing m to vary between 0 and 3 (values from the past full year might be included into the regression), while α is and unknown coefficient of the regression. AR regression is employed for each company *i* separately, selecting lag length separately as well, in order to apply time series models and methods in an analysis.

Afterwards, an extended version of the autoregressive model is exploited to examine the prediction accuracy of selected potential determinants of stock returns for each company. One-step ahead forecasts of returns on shares (R_{it+1}) are made by applying the ARDL model with individual explanatory variables (i.e. each financial metric is included in the separate regressions with its one-period lagged value and lagged values of share returns):

$$R_{it+1} = \alpha + \sum_{k=0}^{m} \beta_k R_{it-k} + \sum_{l=0}^{n} \beta_l X_{it-l} + \varepsilon_{it+1} \quad (13)$$

where *n* and *m* are also selected by the BIC method and are limited by a minimum value of zero and maximum value of three for the same reasons.

The forecasting performance of financial results is evaluated using a pseudo-out-of-sample technique, commonly utilized to replicate real-time forecasting. Sample is split into training data set, which is exploited to make in-sample calculations and holdout sample, which includes actual values of share returns and estimated forecasts are compared against it to get forecasting errors. Expanding estimation sample with a fixed starting period (recursive approach) is used in predicting since it mimics real-time forecasting. The recursive approach is less responsive to outliers, compared to the rolling technique. Forecasting procedure with discrete financial ratios generates a set of stock returns' forecasts for each factor ($\hat{R}_{jit+1}$), allowing to compute forecasting

errors (e_{jit+1}) for each indicator and each company by comparing forecasted values with actual values in holdout sample:

$$e_{jt+1} = \sum_{i=1}^{10}(R_{it+1} - \hat{R}_{jit+1})^2 \quad (14)$$

Forecasting errors based on j^{th} indicator are summed through 10 selected companies in order to compare forecasting performance of different predictors with forecasting accuracy of historical returns taking into account entire information provided by panel data about stock returns and company's financial results relation in Vilnius Stock Exchange. Forecasting errors are squared in order to avoid the situation when forecast errors with negative sign from one company cancels out positive errors from another, yielding invalid results.

The accuracy of predictions in this research is calculated by the most popular measure in the forecasting literature – mean squared forecast error (MSFE). In order to check whether "forecasts with individual financial ratios outperform benchmark forecasts based on historical share return data", relative MSFEs for each j^{th} financial results indicator is calculated by the following formula:

$$relative\ MSFE = \frac{\sum_{t=S-1}^{T-1} e_{jt+1}}{\sum_{t=S-1}^{T-1} e_{AR,t+1}} \quad (15)$$

where S marks the starting period of the holdout sample, T represents last the time period of the last observation in the sample and $e_{AR,t+1}$ is the one-period ahead forecasting error made when applying the AR model.

A common approach in forecasting to get more accurate predictions based on the ones made using individual indicators is combination forecasts, due to the fact that usually there is no one predictor which performs best in all countries, time periods, and model specifications. Different construction methods can be utilized to obtain a combination forecast, but the simple mean technique is the one used in this study since it is easily applicable and proven to perform relatively well. Combination forecasts are calculated by taking the simple arithmetic mean of forecasts produced employing financial metrics as individual predictors ($\hat{R}_{jit+1}$).

In the following section, data utilized to adopt this methodology for Vilnius Stock Exchange is reviewed, together with the results obtained from this analysis.

3. QUANTITATIVE ANALYSIS OF STOCK RETURNS DETERMINANTS AND PREDICTORS

This part of the master thesis focuses on the practical examination of the impact that the announcement of companies' financial results has on their share price changes. Section begins with the analysis of the financial data used in the econometric research about listed companies in the Vilnius Stock Exchange, together with a brief description of each enterprise included in the analysis. It is followed by an interpretation of empirical results, including in-sample and out-of-sample examination of stock returns' determinants and predictors taken or calculated from the accounting statements of the listed firms as defined in Section 2.1. Finally, forecasting results are presented, produced by combination forecasts, demonstrating their practicality in forecasting the share returns of companies established in Lithuania.

3.1. **Overview of companies included in the study**

Before starting data and empirical research results analyses, it is important to understand, which companies qualified for the sample (based on the length and availability requirement for historical financial and stock returns data of the companies) representing the Vilnius Stock Exchange market. Financial statements and stock prices of firms operating in different sectors, of varying sizes, and with diverse goals are influenced by different factors and forces, which can only be appreciated when the companies' backgrounds are known. As a consequence, a brief explanation of each firm included in the analysis is provided in order to evaluate the findings of the econometric research and to better comprehend the acquired data of financial ratios and share returns:

Apranga (APG1L) – a company specializing in the retail trade of apparel, leading the Baltics market in the clothing retail industry (with more than 30% market share). It was established in Lithuania at the beginning of 1993, starting its operations in other Baltic states in the early 2000s. Company was listed in the NASDAQ Vilnius market at the end of 2005, operating stores over the Baltics under the terms of franchise agreements with such worldwide known brands as "Zara", "Emporio Armani", "Massimo Dutti", and others. Based on the publicly available data, "Apranga" has around 2000 employees and a market capitalization of approximately 110 million euros (2022 NASDAQ data).

Grigeo (GRG1L) – a company producing sanitary and household paper products, was established almost one hundred years ago (in 1923) and listed in 1994. Paper and paper goods,

wood fibreboards and wood processing, and raw material for corrugated cardboard and associated products are the company's three reportable sectors. It is the largest firm in its field in Lithuania, as well as one of the market leaders in the Baltics. “Grigeo” employs about 300 staff members and has a market capitalization of around 105 million euros (2022 NASDAQ data).

Klaipėdos Nafta (KNF1L) – a company whose main activity is the management and operation of oil and its products, as well as liquefied natural gas terminals. Company was established in 1959, included in the equity listing from 1994 and almost three-fourths of the company is owned by the state of Lithuania. Approximately 370 employees are working in “Klaipėdos Nafta“ and it has a market capitalization of more than 110 million euros (2022 NASDAQ data).

Kauno Energija (KNR1L) – a company is serving consumers with thermal energy, as well as producing electricity and thermal energy. The firm oversees interior heating and hot water supply systems, as well as the repair and maintenance of heat unit equipment and the provision of rental services. “Kauno Energija” is generating a vast majority of its earnings from heat supplies. It was established in 1963, listed after 35 years (in 1998), and created around 370 working places. The market capitalization of “Kauno Energija” is roughly 40 million euros (2022 NASDAQ data).

Pieno Žvaigždės (PZV1L) – a company is manufacturing milk and dairy products. It is a leading Baltic firm that manufactures and sells dairy products to retail outlets both directly and through wholesalers. The majority of “Pieno Žvaigždės“ revenues come from fresh dairy products. Company is engaged in the constant advancement and development of products trying to foresee the trends of the market. It has more than 1700 employees and a market capitalization of approximately 60 million euros (2022 NASDAQ data).

Snaigė (SNG1L) - a company that is the sole producer and manufacturer of household refrigerators in the Baltic States. The company's product line comprises bottom freezers, top freezers, refrigerators, freezers, vertical coolers, glass door refrigerators, and other related items, sold in Lithuania and internationally. “Snaigė” is operating for almost 60 years (established in 1963) and is listed from 1998. The market capitalization of "Snaigė“ is currently only around 7 million euros, but roughly 540 employees work in this company (2022 NASDAQ data).

Šiaulių Bankas (SAB1L) – a financial institution, established in 1992 and since then it is the largest bank financed by Lithuanian capital, having approximately 900 employees. The bank is focusing on corporate and consumer finance solutions, also funding the implementation of energy conservation programs across the country, participating in apartment building restoration projects, and is the country's leader in rehabilitation financing. The traditional banking activities and lending division provide for the vast bulk of its revenue and it is the fourth largest bank operating in Lithuania with less than 10% of the market share. Since 1994, “Šiaulių Bankas” shares

have been traded on the stock market and now it has a market capitalization of more than 360 million euros (2022 NASDAQ data).

Telia Lithuania (TEL1L) – a telecommunications company, originally based in Sweden and until the 2017 merger was operating under the "Omnitel" name (established in 1991). “Telia Lithuania" supplies to its customers integrated technological solutions and offers IT, TV, and telecommunications services from one source. Business to Customer and Business to Business are two of the company's business models. More than 2000 employees are working for “Telia Lithuania”. This company was listed in 2000 and currently has a market capitalization of more than 1 billion euros, being the largest company by market capitalization in the sample (2022 NASDAQ data).

Utenos Trikotažas (UTR1L) – a company producing knitwear and textile, is the largest manufacturer in the industry across Eastern Europe. Jersey fabrics and ready-to-wear production on demand are the two main fields in which company specializes. It covers the entire manufacturing process, from fibre to a final product. Established in 1967, company currently has about 800 employees and its stocks are trading since 1997 with less than 6 million market capitalization presently (2022 NASDAQ data).

Vilniaus Baldai (VBL1L) – a company manufacturing furniture, obtaining most of its revenues by selling furniture in the European Union countries. Company is responsible for the whole furniture manufacturing process, from design and production to its sale. It is the oldest company in the sample, established in 1883 and growing into one of the largest industrial corporations in Lithuania. Over 400 people are working in "Vilniaus Baldai", which has a market capitalization of more than 30 million euros and was listed in 2000 (2022 NASDAQ data).

As can be observed from the brief descriptions of the selected companies from the Vilnius Stock Exchange, they cover a wide range of sectors and sizes, effectively representing the whole market and demonstrating that the sample is not biased.

3.2. **Analysing financial data in Vilnius Stock Exchange**

All listed companies are required to prepare and publish their financial statements in order to monitor the robustness of their business and provide an accurate and trustworthy view of their operating activities and financial position. Main financial statements are balance sheet statement (provides an overview of a company's assets, liabilities, and stockholders' equity), income statement (provides an overview of the company's revenues, expenses, net income, and earnings per share), and cash flow statement (provides an overview of company’s cash flow generating activities, used to fund operating expenses, investments, and pay debt obligations). These three

financial statements, reported based on the requirements set by IFRS, allows to compute financial ratios used in the analysis as described in Section 2.1.

Financial data for the analysis of stock returns was obtained directly from the NASDAQ Vilnius database and financial statements of companies stored there, as well as through the Bloomberg terminal. Since 10 companies qualified to the sample with quarterly data from 2009 January to 2021 December (52 periods) and their 10 financial indicators are involved in the analysis (eight selected ratios, share prices, and dividend payments for stock returns calculations) around 5200 data points are included in the study. To assure proper data quality and avoid calculation errors in the statistical software utilized for the research (R Studio), gaps in the data were manually filled by taking needed information from the published accounting statements. Furthermore, a data quality check was done to detect suspected outliers, and those data points were manually re-checked and re-calculated to prevent big extremes from occurring due to potential issues in the data-gathering process.

Data used in the research is summarized on a variable level including information on all the analysed companies and time periods, as presented in Table 2.

Table 2

Summary of variables used in the analysis

Variable	*Source*	*p-value*	*Units*	*Min*	*Max*	*Mean*	*SD*
ROA	*Bloomberg/NASDAQ database*	0.000	Percentage	-39.44	29.88	4.82	8.40
ROE	*Bloomberg/NASDAQ database*	0.004	Percentage	-175.35	129.25	7.97	23.75
EPS	*Bloomberg/NASDAQ database*	0.000	Actual	-0.49	1.25	0.04	0.13
Operating cash flow	*Bloomberg/NASDAQ database*	0.000	Millions	-163.62	476.85	7.04	28.27
P/E	*Bloomberg/NASDAQ database*	0.000	Actual	-1754.59	4700.00	18.21	242.60
Financial leverage	*Bloomberg/NASDAQ database*	0.734	Actual	1.04	18.69	3.31	3.26
Net profit margin	*Bloomberg/NASDAQ database*	0.000	Percentage	-326.60	73.69	3.81	28.68
Total asset turnover	*Bloomberg/NASDAQ database*	0.000	Actual	0.04	2.61	1.13	0.74
Return	*Bloomberg/NASDAQ database*	0.000	Actual	-0.76	1.79	0.04	0.23

Source: prepared by the author based on the research

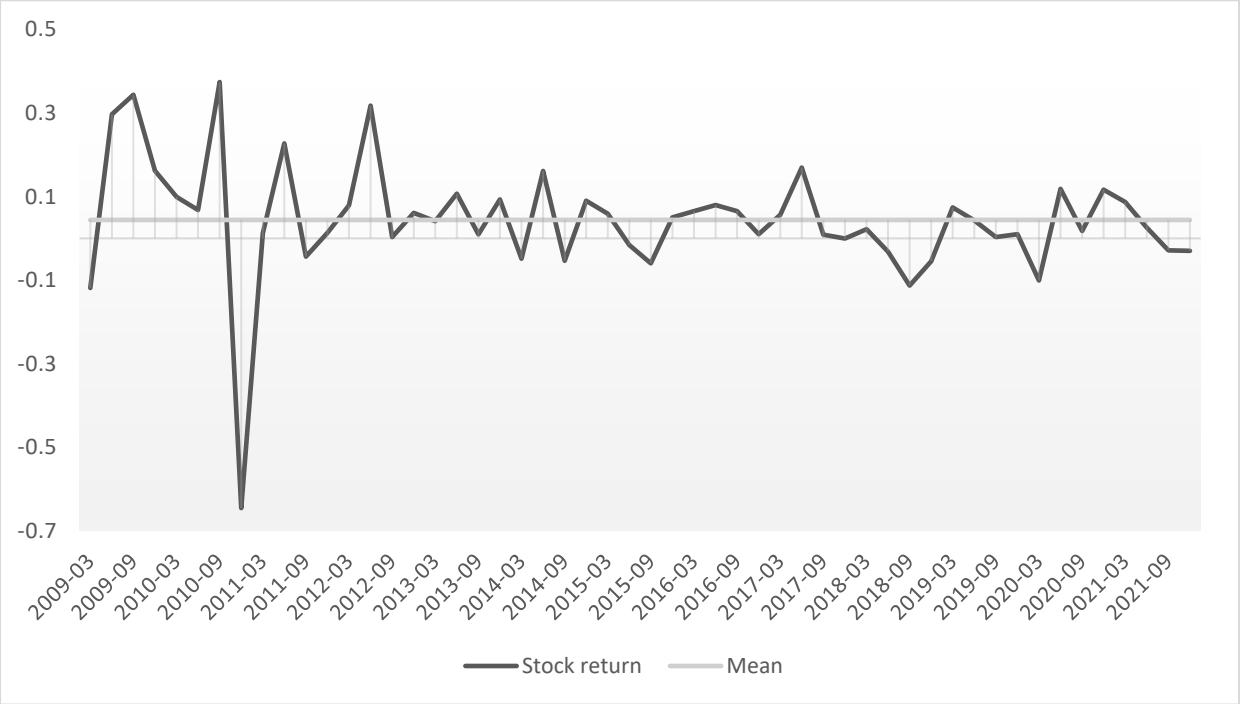
Notes: the first column of the table lists the indicators and stock returns, the second one specifies from where data for each variable was taken (data was extracted through Bloomberg for all indicators, adding manual data where needed using financial reports published in the NASDAQ database), while the third column presents the p-value of the panel data Levin-Lin-Chu Unit-Root test for each of the factor, underlined if it is robust with 5% significance level. In the last four columns, the main statistical metrics of each indicator are presented (minimum value (min), maximum value (max), mean, and standard deviation (sd)) in the units stated in the fourth column

As demonstrated by Table 2, the Levin-Lin-Chu Unit-Root test performed to check the stationarity of listed variables in panel data revealed that only financial leverage fails to reject the null hypothesis of non-stationarity (unit root) presence. Therefore, in further research first difference of financial leverage is used, which shows a change in this metric and is discovered to be a stationary factor. A stationarity condition is required for the variables with a time dimension in econometric models, since non-stationary data which has some trend or cycle, cannot be modelled or forecasted due to its changing mean, variance, and covariance. Non-constant statistical metrics of a variable might lead to spurious regression results and varying relations between the analysed parameters, which are not valid.

Summary statistics of altered data shown in Table 2 expose that stock returns of selected companies in the Vilnius Stock Exchange range from around -76% to 179% during the 2009:Q1-2021:Q4 time span. The largest deviations from the mean are seen in the period when the global financial crisis reached Lithuania (2009-2010) and its aftermath. All of the companies experienced their largest share price decrease in considered history throughout the fourth quarter of 2010 plunging by 65-75% unanimously (except for one company whose stock price plummeted by 60% in the first quarter of 2009). Whereas, stock prices increased the most during the 2011-2013 period, surpassing the previously encountered decline in most of the cases. Proof that these anomalies in share returns are only seen during the global financial crisis times is presented by the mean and standard deviation of stock returns, which are 4% and 23%, respectively. While the volatility of share price changes is quite high due to the global financial crisis and its aftermath period of high volatility being a large portion of the total 13 years of data included in this study, the mean of the stock returns reflects well the long-term growth of the financial markets. For comparison, the historical average quarterly return is around 2.7% for the Standard and Poor (S&P) 500, 2.5% for the MSCI emerging markets index, and 2% for the MSCI world index. Discussed dynamics of stock returns in the Vilnius Stock Exchange (using data from ten chosen companies) are demonstrated in Figure 1 below.

Figure 1

Historical stock return changes in Vilnius Stock Exchange



Source: prepared by the author based on the data from NASDAQ database

From the summary data of indicators wide range of return on equity, operating cash flow, price-to-earnings, and net profit margin with respect to their mean stand out, yielding immense standard deviation. High return on equity values are influenced mainly by three companies ("Snaigė" (SNG1L), "Utenos Trikotažas" (UTR1L), and "Vilniaus Baldai" (VBL1L)), which have the lowest equity values (4 million euro, 7 million euro, and 25 million euro, respectively as of 2021) compared to other selected companies. Low equity value implies that changing net income (the numerator of ROE calculation formula) has a large effect on ROE ratio volatility of these companies. It happens because net income automatically is proportionally bigger compared to equity and, therefore, equity does not have a stabilizing effect on ROE ratio.

Substantial fluctuations in operating cash flow levels are impacted by one company (AB Šialių Bankas (SAB1L)), which is the only financial institution included in the research. Its operating profits are solely impacted by "Other non-cash items", having limited operating expenses, thus its operating cash flow metric is truly volatile. Moreover, as operating cash flow indicates how much is generated from a company's core business and what is liquidity need for growth, for a bank it is substantially fluctuating due to the financial institution's main activities being strongly dependent on the economic situation in the world, monetary policy conducted by the central bank, and behaviour of retail consumers and corporations.

Price-to-earnings ratio, as demonstrated in Section 2.1, uses a sum of trailing twelve months EPS in the denominator of its formula. Hence, there are situations, where summed earnings during the period of twelve months are close to zero from the positive or negative side, resulting in particularly large P/E ratios both ways. As this P/E ratio methodology is widely used in scientific papers and financial reporting, such outliers are considered to be ordinary and reflect the company's valuation ratio at that period of time.

Expenses are driving changes in net profit margin calculations, since in the income statement net income (the numerator in net profit margin calculations) is obtained by subtracting operating costs from revenues (the denominator in net profit margin calculations), besides the impact from additional items (interest expenses, depreciation, equity expenses, taxes, etc.). This means that expenses are negatively related to the net profit margin, increasing costs lead to a bigger difference between revenues and net income, thus lowering the net profit margin. Because of that, the net profit margin is a volatile metric, since companies can experience unexpected costs due to various reasons, which forces a decline in net profit margin. There are no significant outliers in the net profit margin statistics, confirming the prior conclusion that a wide range of values in the net profit margin data is a common phenomenon.

An examination of the data acknowledged that data points gathered through the Bloomberg terminal and directly from the NASDAQ database are credible, without any major technical or data quality issues. For that reason, collected information without any additional adjustments is utilized further in the econometric analysis.

3.3. **Results of financial ratios as determinants of stock returns**

The first part of econometric analysis, described in Section 2.2, focuses on testing the impact that the announcement of companies' financial results has on their future share prices. Research like this tries to figure out how strong and what kind of relationship exists between one dependent variable (stock returns) and a set of other variables (financial ratios). To distinguish the exact effect that individual financial ratios have on share returns and to avoid potential problems of multicollinearity, study begins with simple linear regression models with panel data representing the stock market of Lithuania.

All econometric analyses using panel data regression models in this study start with fixed effects regression. Therefore, eight simple linear regression models with fixed effects, with one selected financial ratio as an independent variable in each model, are created. Then Breusch-Pagan Lagrange Multiplier (LM) time effects test (choosing between fixed effects and time effects model), the Hausman test for univariate regressions (choosing between fixed effects and random effects model), and Breusch-Pagan Lagrange Multiplier (LM) test for pooled OLS (testing whether

pooled OLS estimation method should be used) are employed to establish the final version of simple linear regression model for each potential determinant.

The Breusch-Pagan time effects test has a null hypothesis that no time-fixed effects are needed, meaning that if the null hypothesis is not rejected entity-fixed effects should be employed. As the purpose of the Breusch-Pagan Lagrange Multiplier test is to examine the presence of heteroskedasticity in a linear regression model, the Breusch-Pagan time effects test takes a fixed effects regression model as an input, checks for heteroskedasticity, and compares the results to those obtained with time effects.

If the originally selected fixed effects regression passes the Breusch-Pagan time effects test and is selected over regression with time-fixed effects, the Hausman test helps to determine whether a random effects model should be applied. The main difference between random effects model and fixed effects model is that in the random effects model individual-specific effect is assumed to be drawn from an underlying distribution, while in the fixed effects model individual-specific effect is unique to the individual and not correlated with other individual features. Therefore, the error term and constant of one entity should not be correlated with the error term and constant of the other entities. Under the null hypothesis in the Hausman test, unique error terms are not correlated with the individual regressors (suggesting that a model with random effects should be used), while the alternative states that there is a correlation between particular error terms and independent variables. If the null hypothesis is not rejected (p-value is higher than 5%), a model with random effects is preferred over a model with fixed effects, since the estimator of regression coefficient in the model with random effects is more efficient than the one in fixed effects model.

In case random effects model is selected after the Hausman test, it must be investigated whether a model with pooled OLS estimation method of its coefficient estimator cannot be employed. This is because all of the random effect model's assumptions may be true, but the model simply does not contain an unobserved individual effect, in which case pooled OLS is efficient with all its related statistics being asymptotically correct. The possibility to use a model with pooled OLS estimation technique is tested with the Breusch-Pagan Lagrange Multiplier (LM) test with a null hypothesis that variance of the error terms from a linear pooled OLS regression homoscedastic, while the alternative indicates that heteroskedasticity is present. Thus, if the p-value of the Breusch-Pagan Lagrange Multiplier (LM) test for pooled OLS model is lower than 5% it means that random effects model should be used over a model with pooled OLS coefficient estimation method.

Results of the above-mentioned tests performed for each simple linear regression with individual financial ratios as sole regressors are summarized in Table 3.

Table 3

Results of panel model type tests

Variable	*Time effects test*	*Hausman test*	*Pooled OLS test*	*Selected model*
ROA	0.647	0.358	0.000	Random effects
ROE	0.695	0.117	0.000	Random effects
EPS	0.736	0.829	0.000	Random effects
Operating cash flow	0.757	0.926	0.000	Random effects
P/E	0.675	0.336	0.000	Random effects
Financial leverage	0.743	0.445	0.000	Random effects
Net profit margin	0.742	0.427	0.000	Random effects
Total asset turnover	0.386	0.606	0.000	Random effects

Source: prepared by the author based on the research

Notes: the first column shows the financial ratio that is included as a single independent variable in the tested simple linear regression model, the second to fourth columns show the p-value of the Breusch-Pagan time effects test, Hausman test for univariate regressions, and Breusch-Pagan Lagrange Multiplier (LM) test for pooled OLS, respectively. The last column of the table highlights the selected type of regression model with panel data, which is used in further simple linear regression analysis

From the table it is clear that the null hypothesis of the Breusch-Pagan Lagrange Multiplier test for time effects was failed to reject in all of the models, removing the option of regression with time-fixed effects. Moreover, the Hausman test revealed that random effects model should be employed over regressions with fixed effects (p-value higher than 5%, meaning that individual error terms are not correlated with specific independent variables) and the effectiveness of random effects model was confirmed by Breusch-Pagan Lagrange Multiplier (LM) test for pooled OLS, which rejected homoscedasticity assumption in all individual models with pooled OLS estimation technique (p-value is lower than 5%, rejecting the null hypothesis). For that reason, in further analysis of simple linear regression models with single regressors, panel data model with random effects is used in all cases, which is a less frequently utilized panel data model in scientific research compared to the fixed effects model, but is considered to be more commonly encountered in reality.

After the most efficient and suitable type of panel data regression is selected for each simple linear regression model, the presence of heteroskedasticity and autocorrelation in these models is tested, to make sure that proper statistical inferences can be made and that obtained results will be valid. In case one of the mentioned econometric features is spotted adjustments to standard errors of the regression models are made. Heteroskedasticity is tested with the Breusch-Pagan Lagrange Multiplier test, while the Durbin-Watson test allows to examine serial correlation

in models with panel data. Durbin-Watson test looks for autocorrelation based on AR(1) process with a null hypothesis that there is no first-order serial correlation in the regression.

All random effects models with individual financial ratios as regressors had a p-value equal to 0 in the Breusch-Pagan Lagrange Multiplier test, meaning that the homoscedasticity assumption is rejected and standard errors of estimated coefficients in the regressions will have to be adjusted to take heteroskedasticity into account. Whereas the Durbin-Watson test revealed that autocorrelation is nonexistent in selected panel data simple linear regression models with random effects since the p-value of this test varied between 82% to 90% in these models failing to reject the null hypothesis of no first-order autocorrelation. Because of these findings, heteroskedasticity-robust standard errors are employed in further analysis of all regression models with a sole independent variable when making any kind of statistical inferences.

A summary of simple linear regression results with random effects and heteroskedasticity-robust standard errors are presented in Table 4.

Table 4

Simple linear univariate regression models of stock returns

	Dependent variable:							
	Return							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ROA	0.002 (0.002)							
ROE		0.0005 (0.001)						
EPS			0.147*** (0.051)					
Cashflow				0.0003** (0.0001)				
PE					0.0001*** (0.00003)			
Leverage						0.005 (0.014)		
Profit							0.0003* (0.0002)	
Turnover								0.020 (0.013)
Constant	0.035 (0.022)	0.040* (0.021)	0.038* (0.020)	0.042** (0.020)	0.042** (0.020)	0.044** (0.020)	0.043** (0.020)	0.021 (0.021)
Observations	520	520	520	520	520	520	520	520
R^2	0.007	0.003	0.010	0.002	0.016	0.0003	0.002	0.006
Adjusted R^2	0.006	0.001	0.008	-0.0004	0.014	-0.002	0.001	0.004
F Statistic	3.879**	1.757	5.441**	0.803	8.591***	0.177	1.271	3.317*

*significant at 10% significance level, **significant at 5% significance level, ***significant at 1% significance level

Source: prepared by the author based on the research

Notes: the first column lists the financial ratio that is included in the univariate panel data regression model with random effects together with a mean of entity-specific constant, second to ninth columns show the estimated coefficient in each regression with heteroskedasticity-robust standard errors in the brackets

Results of simple linear univariate regressions modelling share returns with one metric of financial results demonstrate that there are variables that significantly impact changes in stock prices directly. At a 5% significance level, earnings per share, operating cash flow, and price-to-

earnings ratio are observed to be impacting share returns substantially. The adjusted R^2 parameter, which indicates how much variance of the dependent variable is explained by independent variables in the regression, is a bit higher than 1% only in regression with a price-to-earnings ratio, showing that financial results individually have low explanatory power on movements in stock prices. However, F-statistic, which tests the null hypothesis that the data is fit by a model with no independent variables (intercept-only model) as well as a model with regressors (meaning that in case the null hypothesis is rejected R-squared is not zero) is significant at 5% level in three models (ROA, EPS, and P/E). Interestingly, those models are not the same as those in which individual regressors were statistically significant, because while operating cash flow is a significant variable in its regression, the F-statistic for the entire model, which shows statistical significance for the whole regression, suggests that the model's independent variables are not related to the outcome (changes in share prices) collectively. In a model with the ROA financial ratio as the single independent variable, the situation is the polar opposite.

The relationship between financial ratios and share returns in regressions is determined by the significance of estimated coefficients in the model. Nevertheless, in this study conservative approach is chosen that not only do regressors have to be individually substantially impacting the dependent variable, but also the model collectively has to be statistically significant in order to state that some financial metric has an impact on movements in stock prices. Thus, from simple linear regression analysis price-to-earnings and earnings-per-share financial ratios are observed to be considerably affecting the share returns of the companies. Results partly comprehend the findings of analysed scientific papers, which used simple linear regression as one of their analytical tools, since as in Al-Rjoub et al. (2013) paper EPS was found to be a significant determinant, yet in all papers where ROA was tested, it was found to have a material impact on stock returns as well (model with ROA only collectively significant in this study). Nevertheless, examination of the simple linear regression model confirmed the hypothesis that "some financial metrics significantly impact stock returns in simple linear regression".

Simple linear regression is most effective when there is a possibility of multicollinearity in case additional independent variables would be introduced. Otherwise, models with only one regressor are particularly vulnerable to the omitted-variable bias problem, which makes estimates of parameters in regression analysis invalid (biased). As a result, if the variables of interest are not linearly dependent on each other (highly correlated), multivariate regression is chosen. Multicollinearity in this research is tested using correlation analysis and a correlation coefficient of 70% and more is selected as a benchmark point above which two variables are considered to be highly correlated leading to a potential problem of multicollinearity. Correlation analysis is

performed by estimating the interconnection between each pair of variables included in the study, creating a correlation matrix depicted in Figure 2.

Figure 2

Correlation analysis matrix

Source: prepared by the author based on the research

Notes: in columns and rows of this correlation matrix names of eight out of nine variables are presented, since correlation of each variable with the other eight variables is presented, not repeating correlations between the same pair (as result is the same) and excluding correlations between the variable itself (as it is always equal to 1). The correlation coefficient between the variable in a row and the variable in a column is shown in the boxes, which are coloured based on the interconnection magnitude, as demonstrated in the legend on the right.

According to the calculated correlation coefficients of financial ratios with stock returns, shown in the last column of Figure 2, the majority of financial results indicators are almost uncorrelated with stock returns, with the P/E and EPS ratios having the highest correlation of 13% and 8%, respectively. The financial leverage variable was discovered to have a small negative correlation with stock returns and other financial measures (besides net profit margin). Such findings are consistent with those obtained through simple linear regression analysis, in which the price-to-earnings and earnings-per-share factors were the only ones to have a significant impact on share price changes, while the estimated coefficient of financial leverage, while positive, was statistically insignificant. Moreover, correlation analysis revealed that the correlation coefficient

between ROA and ROE financial ratios is 81%, which is higher than the selected benchmark of 70% set for multicollinearity. This finding is expected since according to the scientific literature, Har and Ghafar (2015), who investigated the influence of ROE, ROA, and ROCE on stock prices, these ratios are strongly linked and because of that simple linear regressions were used to account for multicollinearity. As only one pair of variables was detected to be strongly interconnected and as a consequence cannot be included in the multivariate regression together (due to invalid coefficient estimates and potential overfitting being the main multicollinearity problems), three separate models are selected to be tested in the regression analysis with multiple regressors: model with all financial ratios included in the regression as independent variables, model with all selected variables apart from ROA ratio, and a model containing all financial information of the company besides ROE ratio.

To obtain robust and valid results from an econometric analysis using multiple regression models about the relationship between companies' financial results and their share price changes, an equivalent process to distinguish the proper type of model with panel data and to assess its credibility is carried out, just like it was done with simple linear regression models. Regression with random effects is selected as the most suitable model for all three types of regressions used in the multivariate regression analysis. Such decision is made after performing the Breusch-Pagan Lagrange Multiplier test for time effects, which had a p-value higher than 35% in all three models, failing to reject the null that no time-fixed effects are needed, Hausman test, which helped to select random effects model over fixed effects model (p-value higher than 95% in all three models, not rejecting the null that unique error terms are not correlated with the individual regressors), and Breusch-Pagan Lagrange Multiplier test for pooled OLS, which had a p-value equal to 0 in all three models (rejecting the null of homoscedasticity in pooled OLS model), proving that random effects model is the most efficient one.

Similarly as in analysis with simple linear regression models, heteroskedasticity-robust standard errors are used in the further research using multivariate regression models, since selected final model types of all three models were found to experience heteroskedasticity (tested by Breusch-Pagan Lagrange Multiplier test, p-value 0 in all three models) and no autocorrelation (tested by Durbin Watson test, p-value more than 80% in all three models). Results of the multivariate regression analysis using regression with random effects from panel data and including all three models (created in order to avoid potential multicollinearity issue) are summarized in Table 5.

Table 5

Linear multivariate regression models of stock returns

	Dependent variable:		
	Return		
	(1)	(2)	(3)
ROA	0.001	0.001	
	(0.002)	(0.002)	
ROE	-0.0001		0.0001
	(0.001)		(0.001)
EPS	0.100*	0.101*	0.109**
	(0.052)	(0.052)	(0.047)
Cashflow	0.0003**	0.0003**	0.0003**
	(0.0001)	(0.0001)	(0.0001)
PE	0.0001***	0.0001***	0.0001***
	(0.00002)	(0.00003)	(0.00002)
Leverage	0.007	0.007	0.008
	(0.013)	(0.013)	(0.013)
Profit	0.0001	0.0001	0.0001
	(0.0002)	(0.0002)	(0.0002)
Turnover	0.015	0.016	0.017
	(0.014)	(0.014)	(0.014)
Constant	0.015	0.015	0.015
	(0.022)	(0.022)	(0.021)
Observations	520	520	520
R^2	0.034	0.034	0.034
Adjusted R^2	0.019	0.021	0.021
F Statistic	18.130**	18.149**	17.911**

*significant at 10% significance level, **significant at 5% significance level, ***significant at 1% significance level

Source: prepared by the author based on the research

Notes: the first column lists financial ratios that are included in multivariate panel data regression models with random effects together with a mean of entity-specific constant, second to fourth columns show estimated coefficients in each regression with heteroskedasticity-robust standard errors in the brackets

Multivariate regression results reveal that price-to-earnings ratio, operating cash flow, and earnings per share are statistically significant determinants of share returns in the Vilnius Stock Exchange. The same financial ratios were found to be substantially affecting changes in stock prices based on the simple linear regression analysis, confirming their importance. The significance of the price-to-earnings ratio verifies its status as a commonly used financial metric for the valuation of companies and in fundamental share market analysis. Also, it is an expected finding, since the share price is directly involved in the calculation of P/E ratio, which suggests that their interconnection is substantial. The relevance of operating cash flow metric demonstrates that the possibility of a company to generate cash from its day-to-day activities is considered by investors before making investment decisions. Correspondingly, actual income that is produced by a company is observed to be essential for potential shareholders, since earnings per share information is discovered to have a considerable impact on share returns of companies listed in Lithuania capital markets.

In addition, no material difference is spotted between the three models, besides the significance level at which the EPS metric is a notable determinant of stock returns (EPS is statistically significant at a 5% significance level in a model without ROA, while in other models – at 10% significance level). All models are found to be statistically significant when coefficients of the model are considered collectively, which is demonstrated by the F-statistic and allows to interpret results of individual estimated coefficients directly. Adjusted R^2 of the models (focusing on Models 2 and 3 when analysing regression results) increased at least 2 times compared to individual regression models, reaching the 2.1% mark. This means that only a bit more than 2% of stock returns variation can be explained by financial ratios. It can be explained by the fact that expectations of financial results are not considered in this study, while they are reflected in stock prices before actual results are announced, which illustrates why reports of financial results aren't always relevant for stock price changes. Moreover, there are potentially other factors with additional explanatory power, such as macroeconomic variables or other indicators of a company's financial situation that could be captured by expanding this study with additional potential determinants of stock returns.

3.4. **Forecasting changes in share prices with companies' financial results and combination forecasts**

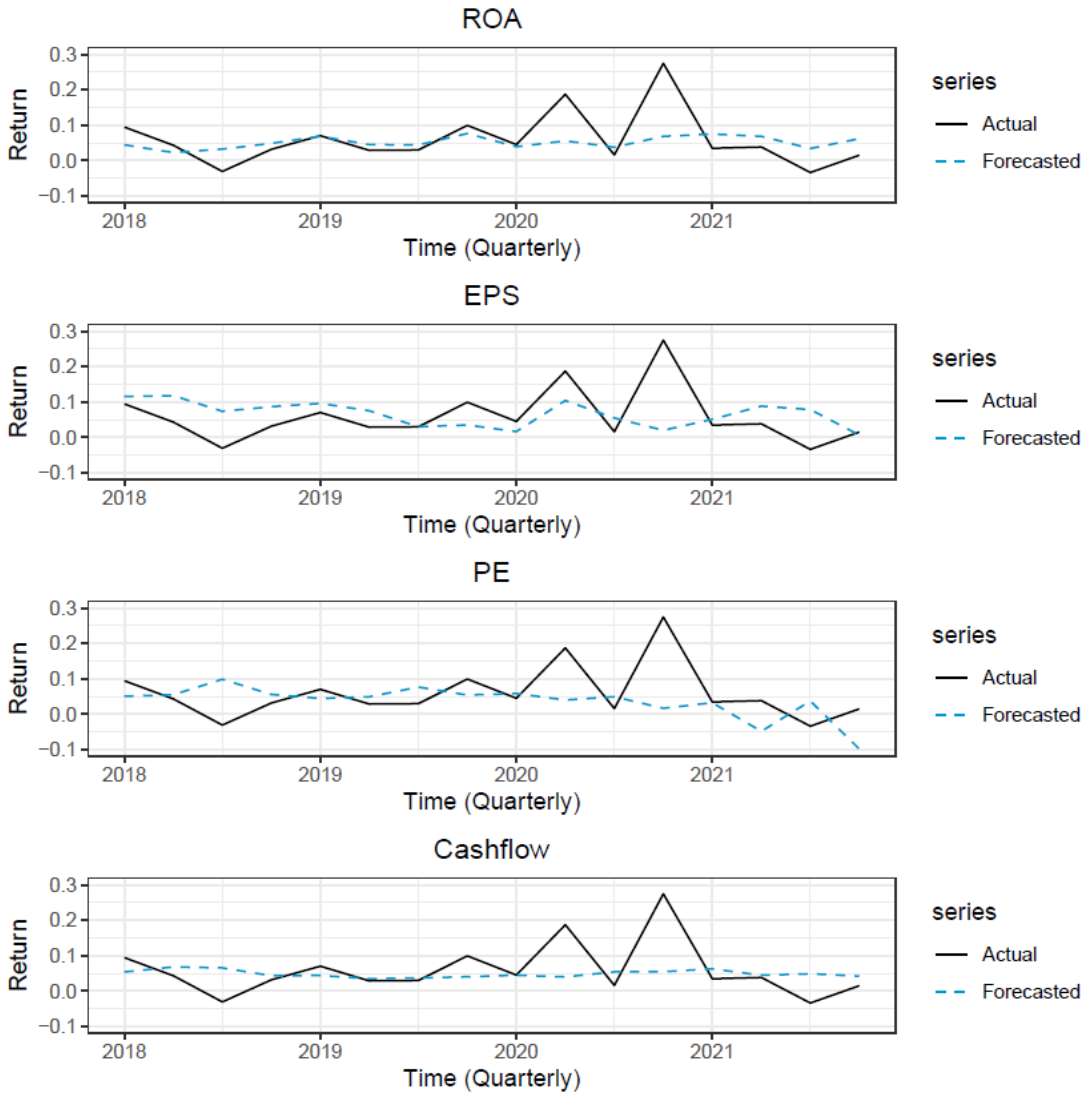
After determining financial ratios which are significantly affecting movements in stock prices of companies listed in the Vilnius Stock Exchange, their relationship with share returns as its predictors is explored in this section. Forecasting performance of companies' financial results in share returns forecasting is an essential feature to be tested, since knowing the ratios which allow to accurately predict share returns would be a big assistance for investors in the investment decision-making process. Whereas knowledge about determinants of stock returns or significant regression models cannot be utilized to make investment choices (it only reveals the relationship between financial indicators and stock returns) until their forecasting accuracy is examined as well.

In the pseudo-out-of-sample method employed in this research to test potential predictors of stock returns sample is split into a training sample based on which models described in Section 2.2 are estimated and a holdout sample which allows to make comparisons with forecasted values and estimate errors. Data from 2009:Q1 until 2017:Q4 is selected as a training sample, while the remaining four-year period is utilized as a holdout sample. The forecasted value of share returns is produced for each of 16 periods in a holdout sample, rolling the sample by one period when estimating the forecasted value of the next period (i.e. no forecasted values are used in further calculations, only the actual values).

Forecasting results are examined in three separate parts: graphical analysis, relative mean squared forecast error analysis for each financial indicator, and analysis of combination forecast using simple mean combination technique. Graphical analysis where actual values of stock prices for some particular company (denoted as R_{it+1} in Section 2.2) are plotted together with the forecasted values ($\hat{R}_{jit+1}$) allows to understand in advance (before checking the actual forecasting results in numbers) what is the prediction power of share return forecasts made using particular indicators and for selected company. Moreover, plot of results is beneficial in order to investigate the dynamics of forecasted results, since no other method employed in the study grasps the changes in forecasting accuracy over time. That kind of examination provides insights whether final stock returns predictability results utilizing historical information about companies' financial results reflects the reality or is heavily impacted by some period of distress or some abnormal behaviour.

Figure 3

Forecasts of "Telia" share returns using leading indicators

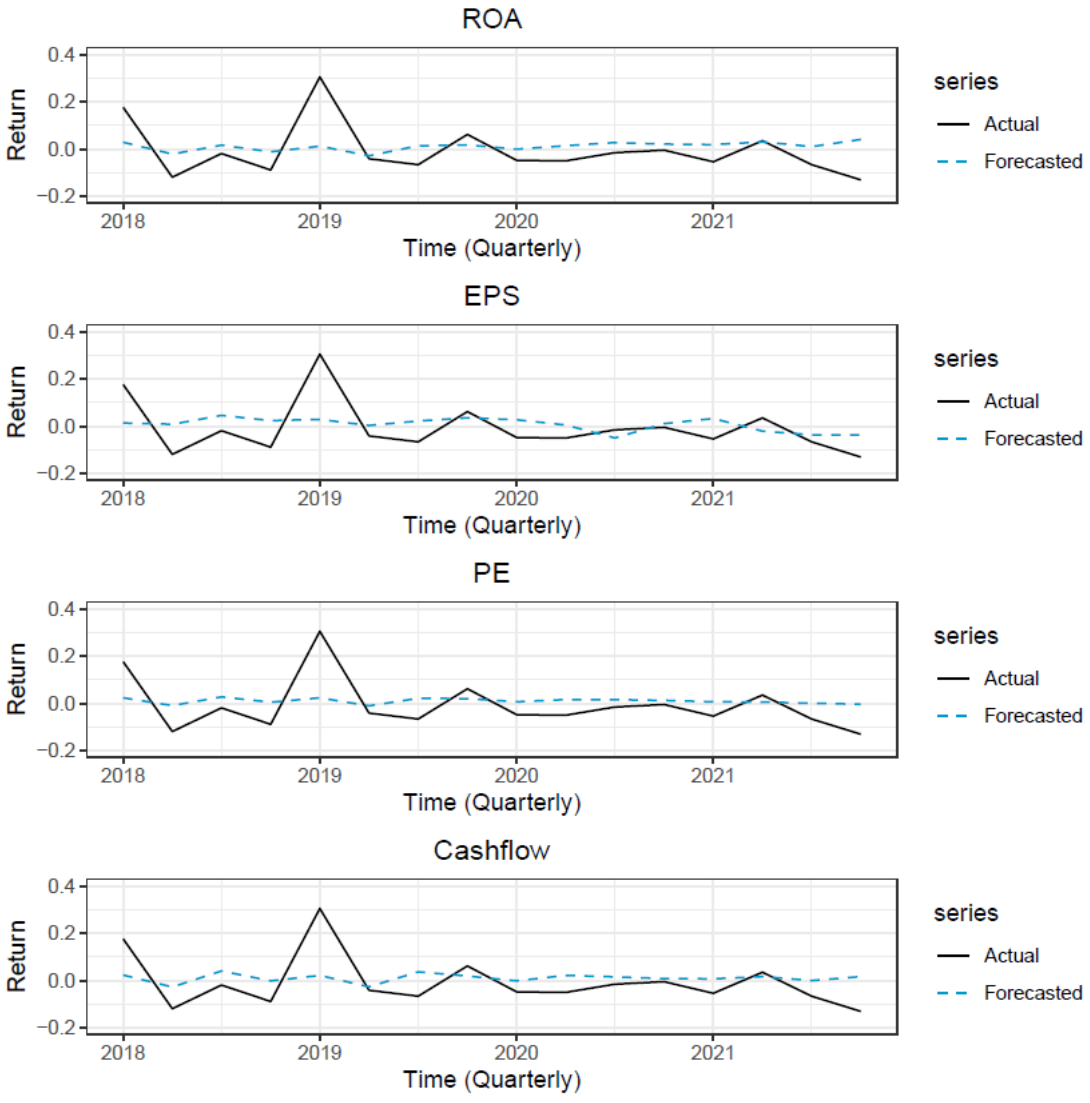


Source: prepared by the author based on the research

Examples of graphical analysis that is performed in this research to evaluate forecasting results are demonstrated in Figure 3 and Figure 4 for leading financial indicators and two companies: “Telia” and “Utenos trikotažas“. Annexes 1-8 provide the remaining figures from graphical analysis of data from all other companies. The study of financial ratios as determinants of share returns is utilized to identify leading financial indicators since according to scholars' findings in other research papers there is an expectation that significant variables in regression analysis are more likely to be helpful in the prediction of dependent variable values. Return on equity, earnings per share, price-to-earnings ratio, and operating cash flow are specified as leading financial indicators in the graphical analysis of forecasting results. Whereas above-mentioned companies were chosen as an illustration of forecasted share returns since they are on the opposite ends of the scale from selected companies in the sample in terms of market capitalization ("Telia" has the highest market capitalization, while “Utenos trikotažas“ has the lowest).

Figure 4

Forecasts of "Utenos trikotažas" share returns using leading indicators



Source: prepared by the author based on the research

Graphical analysis discloses the fact that in both examples (Figure 3 and Figure 4) forecasted results are less volatile than the actual values of share returns, which is particularly seen in the "Utenos Trikatožas" case where almost the same stock returns value is forecasted throughout the period and independently of used leading financial ratio. Predicted values of changes in stock prices seem to be fluctuating around 0 in the "Utenos Trikatožas" instance, while for "Telia" the mean value of forecasted share returns throughout the period appears to be somewhere around the middle point between zero and ten percent marks. The ability of leading financial indicators to forecast larger deviations of listed companies' value is well represented in the figures above since in both cases spikes in the numbers of stock returns are not forecasted with a help from historical financial results of companies, which predict more or less consistent values of stock returns. Such findings suggest that forecasting accuracy using financial ratios when predicting share returns of companies is poor and not dependent on the time period which is chosen for the analysis.

In all different instances with leading financial indicators, corresponding results to the displayed examples of graphical analysis are found, validating the observations from a visual investigation using companies of the largest and smallest values out of selected firms from Lithuania capital markets. Forecasts of share returns that incorporate financial results as well as historical values of share returns do not appear to convey changes in share prices across the time period under consideration. These findings form an expectation that the predictive relationship between the financial results of companies and their share returns is limited.

Although graphical analysis revealed some superficial findings about the performance of four leading indicators in forecasting changes in stock prices of companies listed on the Vilnius Stock Exchange, a more thorough investigation is required to assess the forecasting accuracy of each financial ratio. Such analysis is executed by applying the relative MSFE technique, which is described in Section 2.2. Table 6 presents the empirical findings of the relative MSFE process, with the first line showing the root mean squared forecast error (RMSFE) of the AR model, followed by relative MSFE estimations when each defined financial indicator is separately included in the forecasting regression. The last row of Table 6 exhibits the relative MSFE obtained from the combination of forecasts using a simple average method, which means that individual forecasts produced using single financial ratios are consolidated in each time period of the holdout sample, incorporating the predictive abilities of each financial metric. In Table 6 relative MSFE results below unity (performing better than the AR model) are marked in grey.

Table 6

Relative MSFE table of individual indicators and combination forecast

Financial indicators	Type of indicator	Relative MSFE
AR RMSFE	*AR*	*1.62 (RMSFE)*
Return on assets	Profitability ratio	1.42
Return on equity	Profitability ratio	1.43
Earnings per share	Profitability ratio	1.67
Operating cash flow	Cash flow	1.21
Price-to-earnings	Valuation ratio	1.77
Financial leverage	Solvency ratio	1.18
Net profit margin	Profitability ratio	1.74
Total asset turnover	Efficiency ratio	1.20
Combination	*Mean combination*	*0.98*

Source: prepared by the author based on the research

Notes: in the first line root MSFE of the benchmark AR forecast is presented. The following lines show MSFE of forecasts (displayed in the third column) made using an individual indicator (mentioned in the first column), divided by MSFE of the AR forecast, marked in grey if the indicator produces a more accurate forecast than the AR model. The last row specifies relative MSFE calculated with a simple mean combination forecast. The second column provides the type to which an indicator can be assigned.

The main finding, noticed from Table 6, is that none of the financial ratios have enough predictability power to forecast share returns more precisely than it can be done using historical information of changes in stock prices represented by the AR model. The root mean squared forecast error (RMSFE) of the autoregressive (AR) model is calculated to be 1.62 in the holdout period from 2018:Q1 till 2021:Q4 using data from Vilnius Stock Exchange. Forecasts performed by utilizing financial ratios as additional individual regressors to the prediction model with lagged share returns data are observed to be underperforming forecasts made without supplementary independent variables in the regression (only with historical lagged stock returns data) in a range from 18% to 77% depending on the tested financial metric. Most accurate forecasts from the financial ratios are produced when financial leverage, total asset turnover, and operating cash flow are involved in the regression while forecasting accuracy of P/E, net profit margin, and EPS ratios are detected to be the lowest. Interestingly, only the operating cash flow variable out of the four leading financial indicators was among the best-performing financial metric in the forecasting exercise, suggesting that determinants of share returns are not necessarily the best predictors of

future stock price movements. These discoveries are matching the expectation formed by graphical analysis that companies' financial results are not helpful in forecasting share returns.

Most of the scientific papers focusing on the predictability of share returns and mentioned in Section 1.2 conclude that financial ratios are helpful in forecasting changes in share prices. However, these papers do not compare forecasting accuracy produced using companies' financial results to the one obtained from historical stock returns data, do not test the predictive power of financial ratios individually and are performed in different capital markets, which was proved to be an important factor for dissimilarities in the outcomes of empirical studies. Therefore, such analysis and findings are a novelty in share returns forecasting literature concentrating on Lithuania capital markets, although this forecasting approach is widely used globally in the testing of GDP, inflation, housing prices, and other variables predictability using additional indicators (Stock and Watson, 1999, 2003, 2004).

Nevertheless, as demonstrated by Table 6, combination forecasts using the simple average combining technique outperformed forecasts made using only historical share returns data by approximately 2%. This suggests that, while individual financial ratio estimates aren't very effective in projecting stock returns, when their forecasts are consolidated, even with a simple mean technique, firms' financial performance becomes a good predictor of share returns, beating the benchmark AR model. This result is in accordance with forecasting theory and scientific literature, which states that combination forecasts allow to obtain more robust, accurate, and reliable forecasts (Timmermann, 2006).

CONCLUSIONS AND RECOMMENDATIONS

The ability of different financial metrics and ratios to capture changes in stock prices and to potentially forecast them in the Vilnius Stock Exchange is addressed in this research. Eight dissimilar financial indicators (*ROA, ROE, EPS, net profit margin*, *operating cash flow*, *P/E*, *total asset turnover*, and *financial leverage*) were selected for this purpose based on their performance in other scientific papers. Lithuania's capital market was represented by ten companies, which met the length of historical data and data quality requirements for the 2009:Q1-2021:Q4 period. Determinants of share returns were investigated utilizing simple linear regression, correlation analysis, and multivariate regression models that are the most popular in related research papers. A model with random effects was detected to be the most efficient and suitable in all regression models with panel data in this study. Whereas forecasting accuracy of financial ratios was examined by comparing forecasts made with individual financial indicators as additional predictors of share returns (in the ARDL model together with lagged values of share returns) to the benchmark AR model (regression only with historical stock returns data as regressors). This study is concluded by overviewing attained results through the perspective of six hypotheses that were constructed according to researches performed by other scholars and in order to meet the main goals of this analysis.

In simple linear regression model earnings per share, operating cash flow, and price-to-earnings ratios were found to be statistically significant determinants of share returns at a 5% significance level. However, the statistical significance of the whole model collectively (shown by F-statistic), which was added as an additional requirement in order to state that financial metric is substantially impacting stock returns, was insignificant in the model with operating cash flow as a sole regressor, removing it from the list of significant variables. Nevertheless, a hypothesis that "financial metrics significantly impact stock returns in simple linear regression" was failed to reject.

Furthermore, in order to mitigate omitted variable bias problem and increase explained stock returns variation by independent variables in the regression (measured by adjusted R^2) results of multivariate regression are evaluated. It is done after testing the multicollinearity between independent variables, which if present would result in invalid outcomes. Multicollinearity is tested with correlation analysis and it was found that two profitability ratios (ROA and ROE) are highly correlated and cannot be included in regression together. Thus, a hypothesis that "there is no multicollinearity between chosen independent variables" was rejected.

For that reason, it is recommended to always test for multicollinearity before executing similar analyses with multivariate regression.

Due to the multicollinearity problem three models were examined, one with all indicators, the second without ROA, and the third without ROE. All models generated similar results that the same three financial indicators are significant determinants of share returns. Thus, a hypothesis that "certain measures of financial results substantially impact returns of shares" was failed to reject. Therefore, multivariate regression results yield that EPS, P/E, and operating cash flow have a substantial relationship with share returns and it is recommended to use these three ratios when examining changes in stock prices of companies listed in the Vilnius Stock Exchange.

Explained variation of changes in share prices increased more than 2 times and all models were statistically significant suggesting that multivariate regression should be employed in a similar analysis. Even so, explained variation reached only a bit more than 2% in all models, rejecting the hypothesis that "financial results explain most of the variation in share returns".

Forecasting accuracy analysis was performed using a graphical and empirical representation of the results. Both methods rejected the null hypothesis that "forecasts with individual financial ratios outperform benchmark forecasts based on historical share return data". Predictions made with financial metrics resulted in forecasting accuracy lower by at least 18% compared to the benchmark AR model. Additionally, best performing predictors in forecasting exercise were not exactly the same as observed significant determinants, proving that variables that explain changes in dependent variables are not necessarily good predictors (recommended to check forecasting abilities separately).

However, when forecasted values based on individual financial ratios are combined (simple mean combination technique is sufficient) their forecasting accuracy is higher than the one produced only from historical stock returns information. A hypothesis that "combination of individual forecasts made using company's financial information improves the predictive power of the model" is failed to reject, yielding the recommendation that when forecasting share returns in Vilnius Stock Exchanges information from all companies' main financial results should be taken into account in order to generate relatively accurate forecasts.

Consequently, objectives raised in this research based on the overview of scientific papers are met, because empirical analysis allowed to obtain answers about all highlighted hypotheses. The main goals of this study are also reached, since price-to-earnings ratio, operating cash flow, and earnings per share are found to be statistically significant determinants of share returns in the Vilnius Stock Exchange, while financial ratios are discovered to be useful predictors of changes in stock prices only when forecasts produced using individual indicators in addition to historical

stock returns are combined (outperforming a model solely with lagged share returns values by around 2%).

The main limitation of this research is that expectations of financial ratios are not taken into account. In financial theory and practice, stock prices are reflecting all available public information known by market participants, and expectations of companies' financial results are among this information. Changes in expectations are instantly reflected in the share prices of the company if a market is efficient, therefore potentially being one of the main determinants and predictors of share returns. For that reason, it is suggested for further analysis about this topic to compare differences between announced results and their expectations impact share returns in the Vilnius Stock Exchange. The presumption is such that financial results would be more significant determinants of stock returns, a larger portion of share returns variation would be explained, and possibly deviations of actual results from expected results of some financial ratios would be useful predictors of changes in stock prices individually.

REFERENCES

Al-Rjoub, A. M., Alsharari, N. M., Al-Qudah, A., & Alfawaerah, N. H. (2013). The Relationship between the EPS & the Market Stock Return (Case Study: Industrial Sector-Jordan). *Information and Knowledge Management*, 3, 15-23. Viewed on: 2021-11-28. Internet access: https://www.researchgate.net/publication/262911680_The_Relationship_between_the_EPS_the_Market_Stock_Return_Case_Study_Industrial_Sector-Jordan

Aveh, F., & Awunyo-Vitor, D. (2017). Firm specific determinants of stock prices in an emerging capital market: Evidence from Ghana Stock Exchange. *Cogent Economics & Finance*, 5. Viewed on: 2021-12-11. Internet access: https://doi.org/10.1080/23322039.2017.1339385

Bagdonas, R., & Balsytė, I. (2005). Vertybinių popierių rinkos indeksų priklausomybė nuo šalies makroekonominių rodiklių. *Lietuvos statistikos darbai*, 42, 64 -73. Viewed on: 2021-12-13. Internet access: https://etalpykla.lituanistikadb.lt/object/LT-LDB-0001:J.04~2005~1367151193406/J.04~2005~1367151193406.pdf

Ball, R., & Brown, P. (1968). An empirical evaluation of accounting income numbers. *Journal of accounting research*, 159-178. Viewed on: 2021-11-16. Internet access: https://www.jstor.org/stable/2490232

Bondt, G. (2008). Determinants of Stock Prices: New International Evidence. *The Journal of Portfolio Management*, 34, 81-92. Viewed on: 2021-12-10. Internet access: https://doi.org/10.3905/JPM.2008.706246

Chen, A., & Tu, E.H. (2002). The determinants for stock returns in emerging markets: the case of Taiwan. *Studies in Economics and Finance*, 20, 58-77. Viewed on: 2021-11-29. Internet access: https://doi.org/10.1108/EB028765

Chen, D., Chen, C., & Wu, S. (2014). VaR and the cross-section of expected stock returns: an emerging market evidence. *Journal of Business Economics and Management*, 15, 441-459. Viewed on: 2021-11-29. Internet access: https://doi.org/10.3846/16111699.2012.744343

Das, N., & Pattanayak, J.K. (2009). Analysis of the fundamental factors affecting the market price of shares constituting the Indian index: a study of SENSEX. *International Journal of Accounting and Finance*, 1, 323-355. Viewed on: 2021-12-06. Internet access: https://doi.org/10.1504/IJAF.2009.026626

Dzikevičius, A., & Šaranda, S. (2011). Can financial ratios help to forecast stock prices? *Journal of Security and Sustainability Issues*, 1(2), 147-157. Viewed on: 2021-12-16. Internet access: https://journals.lka.lt/journal/jssi/article/1692/file/pdf

Fama, E. F., & French, K. R. (1992). The cross-section of expected stock returns. *Journal of Finance*, 47(2), 427-465. Viewed on: 2021-11-14. Internet access: https://doi.org/10.2307/2329112

Fama, E. F., & French, K. R. (1993). Common risk factors in the return on stocks and bonds. *Journal of Financial Economics*, 33, 3-56. Viewed on: 2021-11-14. Internet access: https://doi.org/10.1016/0304-405X(93)90023-5

Fama, E. F., & French, K. R. (1995). Size and book-to-market factors in earnings and returns. *Journal of Finance*, 50, 131-155. Viewed on: 2021-11-14. Internet access: https://doi.org/10.1111/j.1540-6261.1995.tb05169.x

Fama, E. F., & French, K. R. (1996). Multifactor explanations of asset pricing anomalies. *Journal of Finance*, 51, 55-84. Viewed on: 2021-11-14. Internet access: https://ssrn.com/abstract=7365

Fama, E. F., & French, K. R. (1998). Value versus growth: The international evidence. *Journal of Finance*, 53, 1975-1999. Viewed on: 2021-11-14. Internet access: https://www.jstor.org/stable/117458

Fama, E. F., & French, K. R. (2004). The capital asset pricing model: Theory and evidence. *Journal of economic perspectives*, 18(3), 25-46. Viewed on: 2021-12-02. Internet access: https://doi.org/10.1257/0895330042162430

Ghasempour, A., & Ghasempour, M. (2013). The Relationship between Operational Financial Ratios and Firm's Abnormal Stock Returns. *Research Journal of Applied Sciences, Engineering and Technology*, 6, 2839-2845. Viewed on: 2021-11-29. Internet access: https://pdfs.semanticscholar.org/be9c/1dab4a8ef99fcb838f36948bde6f550b717b.pdf

Graham, B., Dodd, D. L. F., & Cottle, S. (1934). *Security analysis* (Vol. 452). New York: McGraw-Hill. Viewed on: 2021-11-16. Internet access: https://bridgecollege.net/download/75/accounting-and-finance/6485/00899.pdf

Griffin, J. M. (2002). Are the Fama and French factors global or country specific? *The Review of Financial Studies*, 15(3), 783-803. Viewed on: 2021-11-16. Internet access: http://dx.doi.org/10.2139/ssrn.262647

Hakim, L., & Kusmanto, K. (2020). Determinants of Stock Return and its Implications Divident Policy in Mining sector in Indonesia Stock Exchange. *Utopía Y Praxis Latinoamericana*, 25(1), 208-224. Viewed on: 2021-12-05. Internet access: https://produccioncientificaluz.org/index.php/utopia/article/view/31893/33478

Hamidah (2015). EVA , ROCE , ROE , and EPS as Method of Assessment of Financial Performance and Its Effect on Shareholders ' Wealth : Evidence From Bank Listed at Indonesian Stock Exchange in 2011 – 2013. *International Journal of Scientific and Research Publications*, 5(2). Viewed on: 2021-12-05. Internet access: http://www.ijsrp.org/research-paper-0215/ijsrp-p3881.pdf

Har, W. P., & Ghafar, M. (2015). The Impact of Accounting Earnings on Stock Returns: The Case of Malaysia's Plantation Industry. *International Journal of Biometrics*, 10, 155. Viewed on: 2021-11-28. Internet access: https://pdfs.semanticscholar.org/211e/df917d36988acd4f931cbfdce2defd2fc7e6.pdf

Harasty, H., & Roulet, J. (2000). Modeling Stock Market Returns. *Journal of Portfolio Management*, 26 (2), 33-46. Viewed on: 2021-12-10. Internet access: https://jpm.pm-research.com/content/iijpormgmt/26/2/33.full.pdf

Hsing, Y. (2011). Macroeconomic Variables and the Stock Market: the Case of Lithuania. *The Review of Finance and Banking*, 3, 31-37. Viewed on: 2021-12-15. Internet access: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.972.9950&rep=rep1&type=pdf

IMF (2021). *World Economic Outlook (2021 October).* Viewed on: 2021-12-14. Internet access: https://www.imf.org/external/datamapper/datasets/WEO

Juniarta, I. W., & Purbawangsa, I. (2020). The effect of financial performance on stock return at manufacturing company of Indonesia stock exchange. *Russian Journal of Agricultural and Socio-Economic Sciences*, 97, 11-19. Viewed on: 2021-12-02. Internet access: https://pdfs.semanticscholar.org/2673/92b48e05307d0a4a4e367587292237590447.pdf

Jurkšas, Linas & Paškevičius, Arvydas. (2017). The Relationship Between Macroeconomy and Asset Prices: Long Run Causality Evidence From Lithuania. *Organizations and Markets in Emerging Economies*, 8, 63-85. Viewed on: 2021-12-14. Internet access: https://www.journals.vu.lt/omee/article/view/14198/13093

Kabajeh, M. A. M., Al Nuimat S. M. A., & Dahmash, F. N. (2012). The Relationship between the ROA, ROE and ROI Ratios with Jordanian Insurance Public Companies Market Share

Prices. *International Journal of Humanities and Social Science*, 2(11), 115-120. Viewed on: 2021-12-09. Internet access: http://www.ijhssnet.com/journals/Vol_2_No_11_June_2012/12.pdf

Kheradyar, S., Ibrahim, I., & Nor, F. (2011). Stock Return Predictability with Financial Ratios. *International Journal of Trade, Economics and Finance*, 2, 391-396. Viewed on: 2021-12-16. Internet access: http://www.ijtef.org/papers/137-S00072.pdf

Lewellen, J. (2004). Predicting Returns with Financial Ratios. *Journal of Financial Economics*, 74(2), 209-235. Viewed on: 2021-12-14. Internet access: https://doi.org/10.1016/j.jfineco.2002.11.002

Lintner, J. (1965a). The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets. *The review of economics and statistics*, 47, 13–37. Viewed on: 2021-12-02. Internet access: https://doi.org/10.2307/1924119

Lintner, J. (1965b). Security prices, risk, and maximal gains from diversification. *The journal of finance*, 20(4), 587-615. Viewed on: 2021-12-02. Internet access: https://doi.org/10.2307/2977249

Mallikarjuna, M. & Rao, R. (2019). Evaluation of forecasting methods from selected stock market returns. *Financial Innovation*, 5. Viewed on: 2021-12-17. Internet access: https://jfin-swufe.springeropen.com/track/pdf/10.1186/s40854-019-0157-x.pdf

Mossin, J. (1966). Equilibrium in a capital asset market. *Econometrica: Journal of the econometric society*, 768-783. Viewed on: 2021-12-02. Internet access: https://doi.org/10.2307/1910098

Muhammad, N. & Scrimgeour, F. (2014). Stock Returns and Fundamentals in the Australian Market. *Asian Journal of Finance & Accounting*, 6(1). Viewed on: 2021-12-08. Internet access: https://doi.org/10.5296/ajfa.v6i1.5486

Musah, A. & Aryeetey, M. (2021). Determinants of Share Price of Listed Firms in Ghana. *Economic Insights - Trends and Challenges*, 10, 57-71. Viewed on: 2021-12-12. Internet acsess: https://doi.org/10.51865/EITC.2021.01.06

Natarajan, R., Sivakavitha, S., & Vasani, S. A. (2020). Relationship Between Stock Return And Firms' Financial Performance In Bse Listed Companies. *European Journal of Molecular & Clinical Medicine*, 7(3), 4553-4559.Viewed on: 2021-11-10. Internet access: https://ejmcm.com/article_4688_b34cb50122b150035f69cfbdd4524584.pdf

Palepu, K. G., Healy, P. M., Bernard, V. L., Wright, S., Bradbury, M., & Lee, P. (2010). *Business Analysis & Valuation: Using Financial Statements* (4ed.). Mason: South-Western Cengage Learning. Viewed on: 2021-12-04. Internet access: http://students.aiu.edu/submissions/profiles/resources/onlineBook/f4N3P2_Business%20Analysis%20and%20Valuation%20UFS.pdf

Perold, A.F. (2004). The Capital Asset Pricing Model. *Journal of Economic Perspectives*, 18, 3-24. Viewed on: 2021-12-02. Internet access: https://doi.org/10.1257/0895330042162340

Pilinkus, D. (2009). Stock market and macroeconomic variables: evidences from Lithuania. *Economics & Management*, 14, 884–891. Viewed on: 2021-12-16. Internet access: https://ecoman.ktu.lt/index.php/Ekv/article/view/9487/4810

Pilinkus, D., & Boguslauskas, V. (2009). The Short-Run Relationship between Stock Market Prices and Macroeconomic Variables in Lithuania: An Application of the Impulse Response Function. *Engineering Economics*, 5. Viewed on: 2021-12-15. Internet access: https://inzeko.ktu.lt/index.php/EE/article/view/11607/6291

Pritchard, N. (2002). The Relationship between Accounting Numbers and Returns in the Baltic Stock Markets. CERT Discussion Paper, 206. Viewed on: 2021-12-06. Internet access: https://www2.hw.ac.uk/sml/downloads/cert/wpa/2002/dp0206.pdf

Riley Jr, R. A., Pearson, T. A., & Trompeter, G. (2003). The value relevance of non-financial performance variables and accounting information: the case of the airline industry. *Journal of accounting and public policy*, 22(3), 231-254. Viewed on: 2021-12-10. Internet access: https://doi.org/10.1016/S0278-4254(03)00021-8

Saeidi, P., & Okhli, A. (2012). Studying the effect of assets return rate on stock price of the companies accepted in Tehran stock exchange. *Business and Economic Horizons*, 8, 12-22. Viewed on: 2021-12-07. Internet access: https://academicpublishingplatforms.com/downloads/pdfs/beh/volume8/201607060908_02_BEH_Vol8_Issue2_2012_Saeidi_and_Okhli_Effect_assets_return_rate_on_stock_price_pp.12-22.pdf

Saleh, M. (2015). Relationship between Firm's Financial Performance and Stock Returns: Evidence from Oil and Gas Sector Pakistan. *Journal of Energy Technologies and Policy*, 5, 27-32. Viewed on: 2021-12-07. Internet access: https://www.iiste.org/Journals/index.php/JETP/article/view/26806/27466

Schrimpf, A. (2010). International stock return predictability under model uncertainty. *Journal of International Money and Finance*, 29(7), 1256-1282. Viewed on: 2021-11-30. Internet access: https://doi.org/10.1016/j.rfe.2009.04.004

Sharif, T., Purohit, H., & Pillai, R. (2015). Analysis of Factors Affecting Share Prices: The Case of Bahrain Stock Exchange. *International journal of economics and finance*, 7 (3), 207. Viewed on: 2021-12-09. Internet access: https://pdfs.semanticscholar.org/31d5/8c216414658d0a76ee16e693daf25a7a73aa.pdf

Sharpe, W. F. (1964). Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk. *The Journal of Finance*, 19(3), 425–442. Viewed on: 2021-12-02. Internet access: https://doi.org/10.2307/2977928

Stock, J. H., & Watson, M. W. (1999). Forecasting inflation. *Journal of Monetary Economics*, 44(2), 293-335. https://doi.org/10.1016/S0304-3932(99)00027-6

Stock, J. H., & Watson, M. W. (2003). How Did Leading Indicator Forecasts Perform During the 2001 Recession? *FRB Richmond Economic Quarterly (Summer 2003)*, 89(3), 71-90. https://doi.org/10.1002/for.928

Stock, J. H., & Watson, M. W. (2004). Combination Forecasts of Output Growth in a Seven-Country Data Set. *Journal of Forecasting*, 23, 405-430. https://ssrn.com/abstract_id=2184936

Timmermann, A. (2006). Forecast Combinations. In G. Elliott, C.W.J. Granger & A. Timmermann (Eds.), *Handbook of Economic Forecasting* (Vol. 1, p.p. 135-196). Elsevier. Viewed on: 2021-12-10. Internet access: https://doi.org/10.1016/S1574-0706(05)01004-9

Treynor, J. L. (1962). Toward a Theory of Market Value of Risky Assets. *Unpublished manuscript. Final version in Asset Pricing and Portfolio Performance, 1999, Robert A. Korajczyk, ed., London: Risk Books*, pp. 15–22. Viewed on: 2021-12-02. Internet access: http://dx.doi.org/10.2139/ssrn.628187

Uwuigbe, U., Olusegun, O., & Godswill, A. (2012). An Assessment of the Determinants of Share Price in Nigeria: A Study of Selected Listed Firms. *ACTA Universities Danubius*, 8(6). Viewed on: 2021-12-11. Internet access: http://journals.univ-danubius.ro/index.php/oeconomica/article/view/1507

DETERMINING THE RELATIONSHIP BETWEEN THE FINANCIAL RESULTS OF COMPANIES LISTED ON THE VILNIUS STOCK EXCHANGE AND THE RETURN ON SHARES

DOMANTAS PIKŪNAS

Master Thesis

Finance and Banking programme

Faculty of Economics and Business Administration of Vilnius University

Supervisor – lecturer Algimantas Laurinavičius, Vilnius, 2022

SUMMARY

68 pages, 4 figures (without 8 in Annexes), 6 tables, 53 references.

Using a sample of ten companies listed on the Vilnius Stock Exchange from January 2009 to December 2021, this academic paper investigates the association between their financial results and share returns. In this research, eight main financial ratios are chosen and evaluated as determinants and predictors of stock returns. The thesis starts with a review of previous studies, followed by a description of the methodology used, data collected, and analysis of the results.

The literature on share return determinants and predictors is discussed in the examination of past studies, based on which metrics representing company's financial results are chosen, six principal hypotheses are formulated, techniques for empirical analysis are chosen, and expected results are formed.

Random-effects model was found to be superior to alternative panel data regression models, and it revealed that EPS, P/E, and operating cash flow ratios have a significant relationship with share returns. Studied financial results indicators were found to account for approximately 2% of the variation in share prices, which can be explained by the importance of a company's financial results expectations for stock prices prior to the announcement of actual financial results, as well as other potential indicators (macroeconomic, financial, company-specific) having additional explanatory power.

The forecasting accuracy of financial ratios was assessed by including variables under discussion as regressors into a basic ARDL model and comparing results to benchmark AR model predictions based on MSFE-measured forecast errors. Afterwards, combinations of individual forecasts were generated. None of the individual predictors reduced the forecast error of the benchmark model, while it was achieved using combination forecast approach, indicating that combination forecasts should be utilized in practice when forecasting stock returns on the Vilnius Stock Exchange.

VILNIAUS VERTYBINIŲ POPIERIŲ BIRŽOJE LISTINGUOJAMŲ ĮMONIŲ FINANSINIŲ REZULTATŲ IR AKCIJŲ GRĄŽOS RYŠIO NUSTATYMAS

DOMANTAS PIKŪNAS

Magistro baigiamasis darbas

Finansų ir bankininkystės programa

Vilniaus universiteto Ekonomikos ir verslo administravimo fakultetas

Darbo vadovas – dėstytojas Algimantas Laurinavičius, Vilnius, 2022

SANTRAUKA

68 puslapiai, 4 iliustracijos (be 8 esančių Prieduose), 6 lentelės, 53 literatūros šaltiniai.

Šiame akademiniame darbe, pasitelkiant dešimties Vilniaus vertybinių popierių biržoje listinguojamų įmonių imtį nuo 2009 m. sausio iki 2021 m. gruodžio mėn., nagrinėjama jų finansinių rezultatų ir akcijų grąžos sąsaja. Šiame tyrime pasirinkti aštuoni pagrindiniai finansiniai rodikliai, kurie yra įvertinami kaip potencialūs akcijų grąžą lemiantys bei prognozuojantys veiksniai. Šiame baigiamajame darbe apžvelgiami ankstesni tyrimai, aprašoma taikyta metodika, surinkti duomenys ir pateikiama rezultatų analizė.

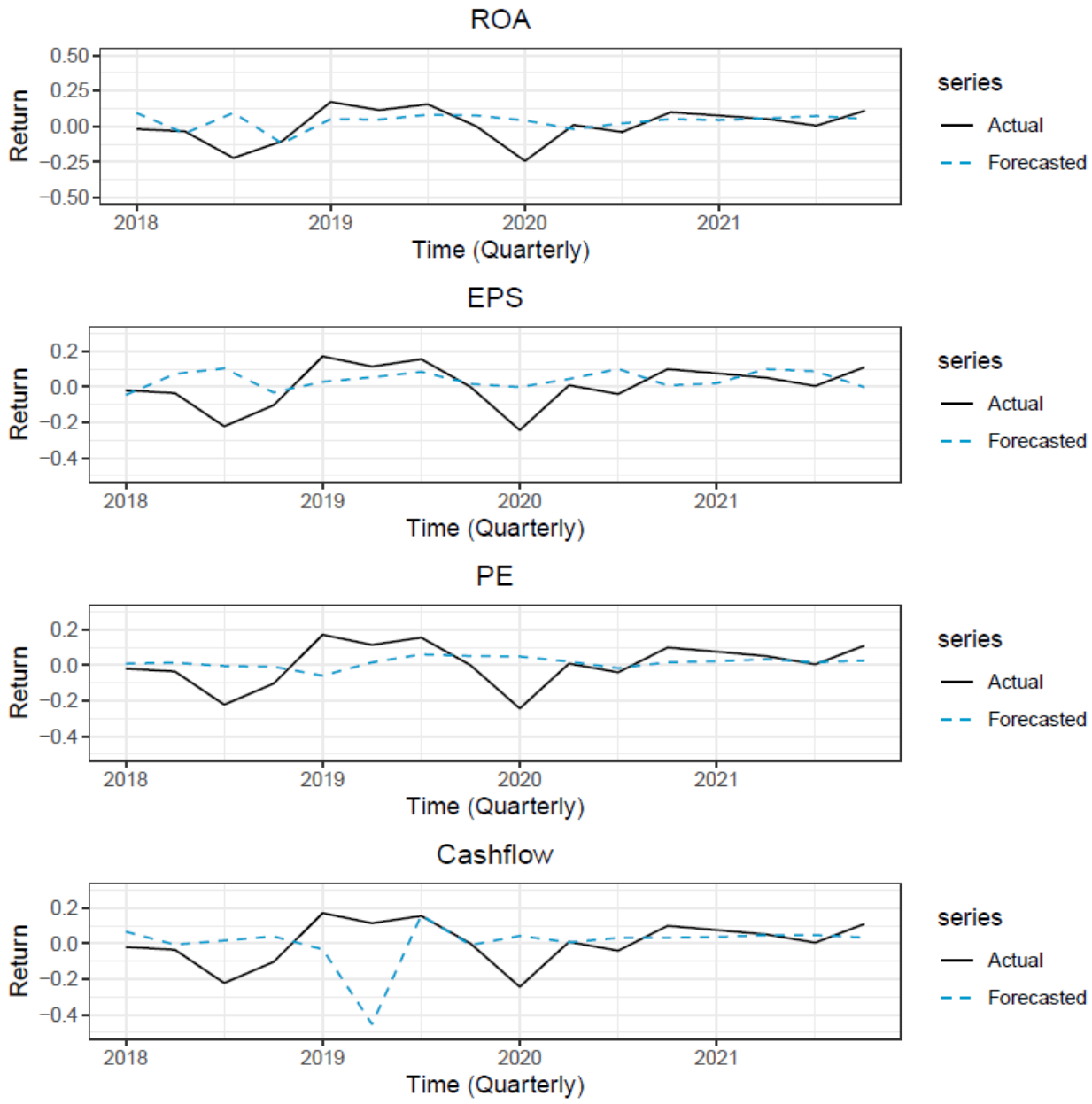
Literatūra apie akcijų grąžą lemiančius ir prognozuojančius veiksnius aptariama nagrinėjant praeityje atliktus tyrimus, kuriais remiantis parenkami įmonės finansinius rezultatus atspindintys rodikliai, suformuluojamos šešios pagrindinės hipotezės, pasirenkami empirinės analizės metodai ir formuojami tikėtini rezultatai.

Atsitiktinių efektų modelis įrodytas kaip pranašesnis už alternatyvius panelinių duomenų regresijos metodus ir atskleidė, kad EPS, P/E bei veiklos pinigų srauto rodikliai turi reikšmingą ryšį su akcijų grąža. Nustatyta, kad tirti finansinių rezultatų rodikliai paaiškina apie 2% akcijų kainų kitimo, o tai galima pagrįsti įmonės finansinių rezultatų lūkesčių svarba akcijų kainoms iki faktinių finansinių rezultatų paskelbimo, taip pat kitais galimais rodikliais (makroekonominiais, finansiniais, konkrečiai įmonei būdingais), turinčiais papildomos aiškinamosios galios.

Finansinių rodiklių prognozavimo tikslumas buvo įvertintas tiriamus rodiklius įtraukus kaip regresorius į pagrindinį ARDL modelį ir palyginus rezultatus su standartinėmis AR modelio prognozėmis, pagrįstomis MSFE būdu išmatuotomis prognozių paklaidomis. Vėliau buvo sugeneruotos individualių prognozių kombinacijos. Nė viena iš individualių prognozių nesumažino standartinio modelio prognozės paklaidos, bet tai buvo pasiekta taikant kombinuotųjų prognozių metodą, tad tai rodo, kad prognozuojant akcijų grąžą Vilniaus vertybinių popierių biržoje turėtų būti naudojamos kombinuotos prognozės.

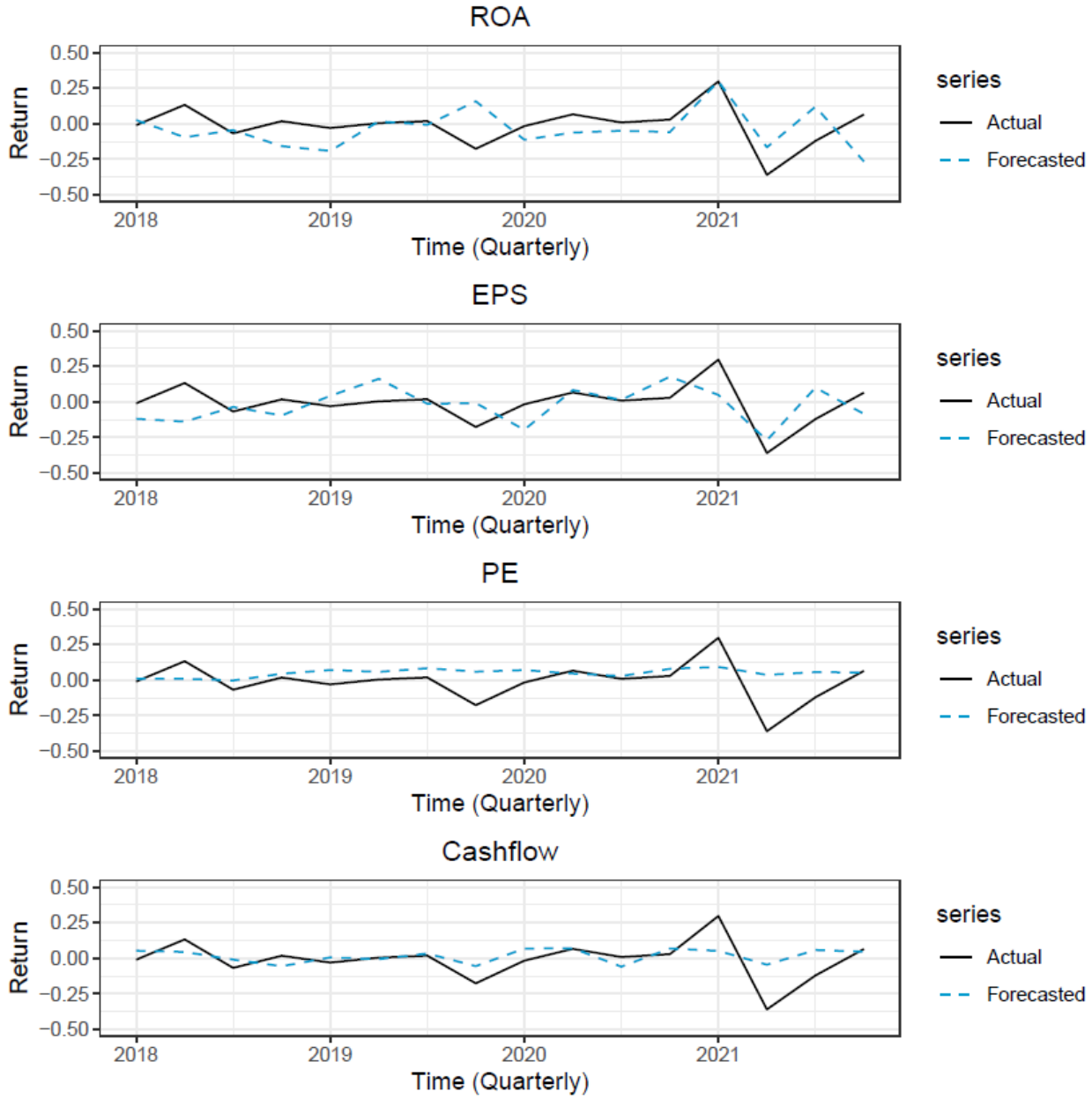
ANNEXES

Annex 1. Forecasts of "Apranga" share returns using leading indicators



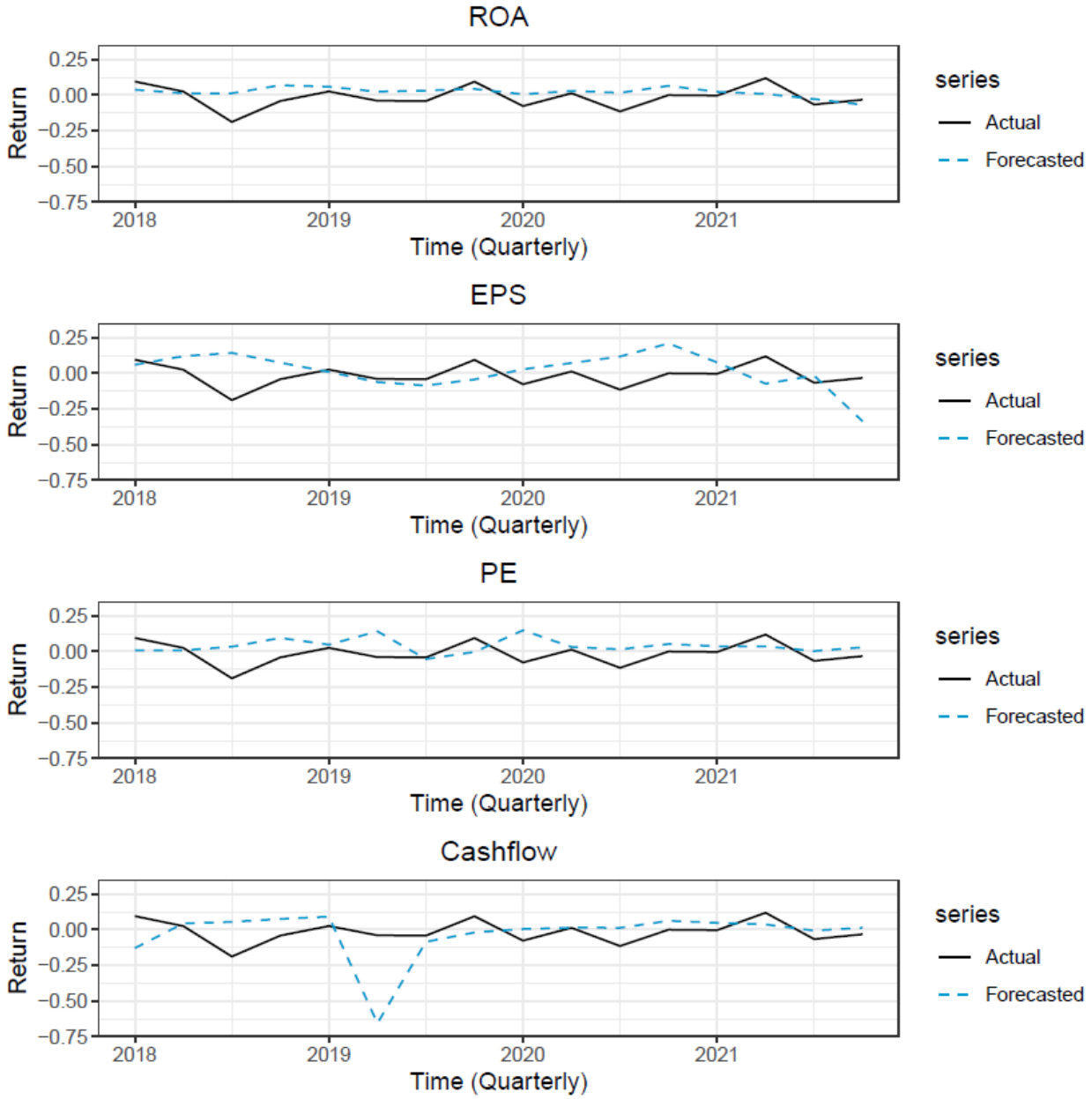
Source: prepared by the author based on the research

Annex 2. Forecasts of "Grigeo" share returns using leading indicators



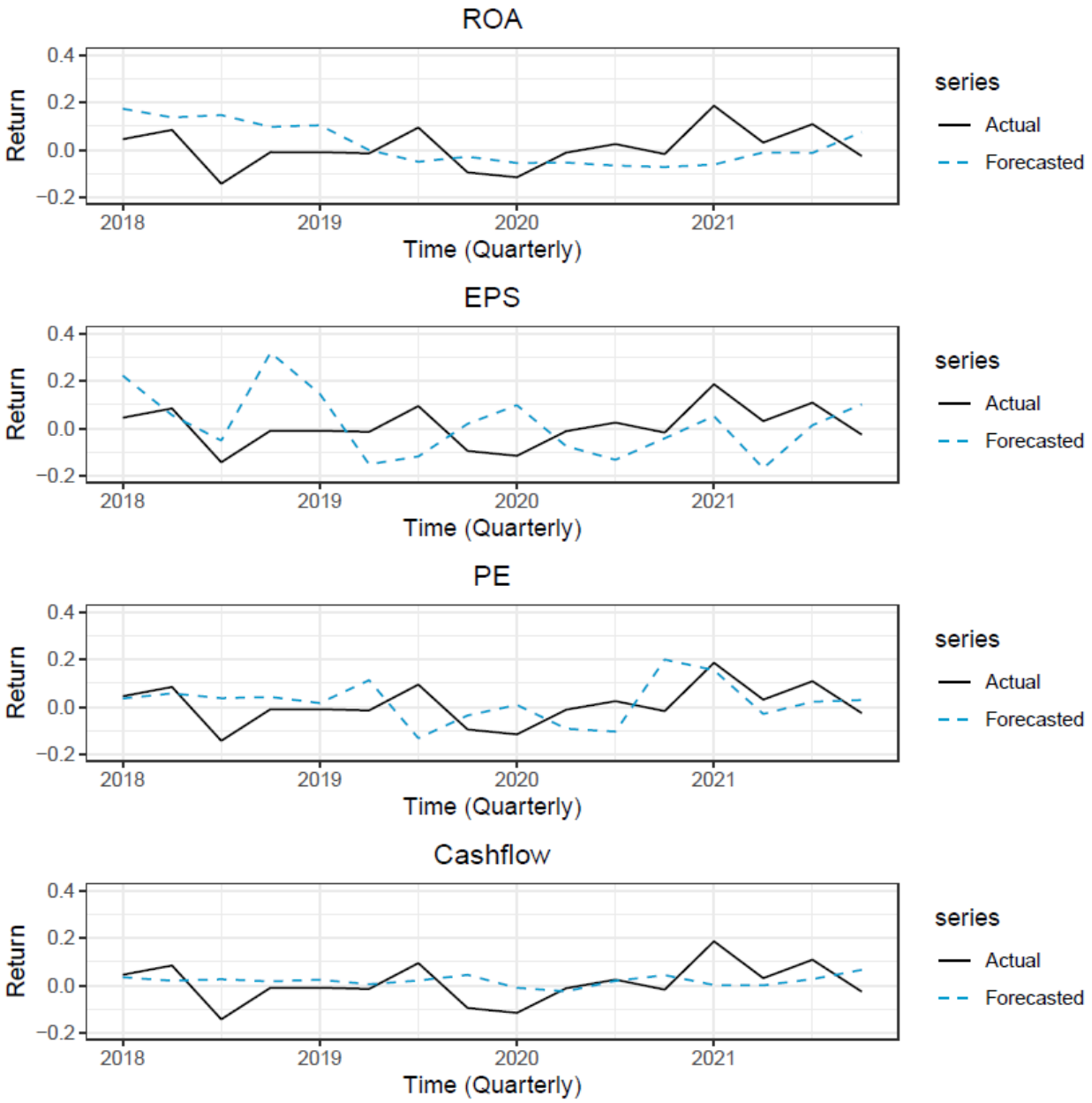
Source: prepared by the author based on the research

Annex 3. Forecasts of "Klaipėdos Nafta" share returns using leading indicators



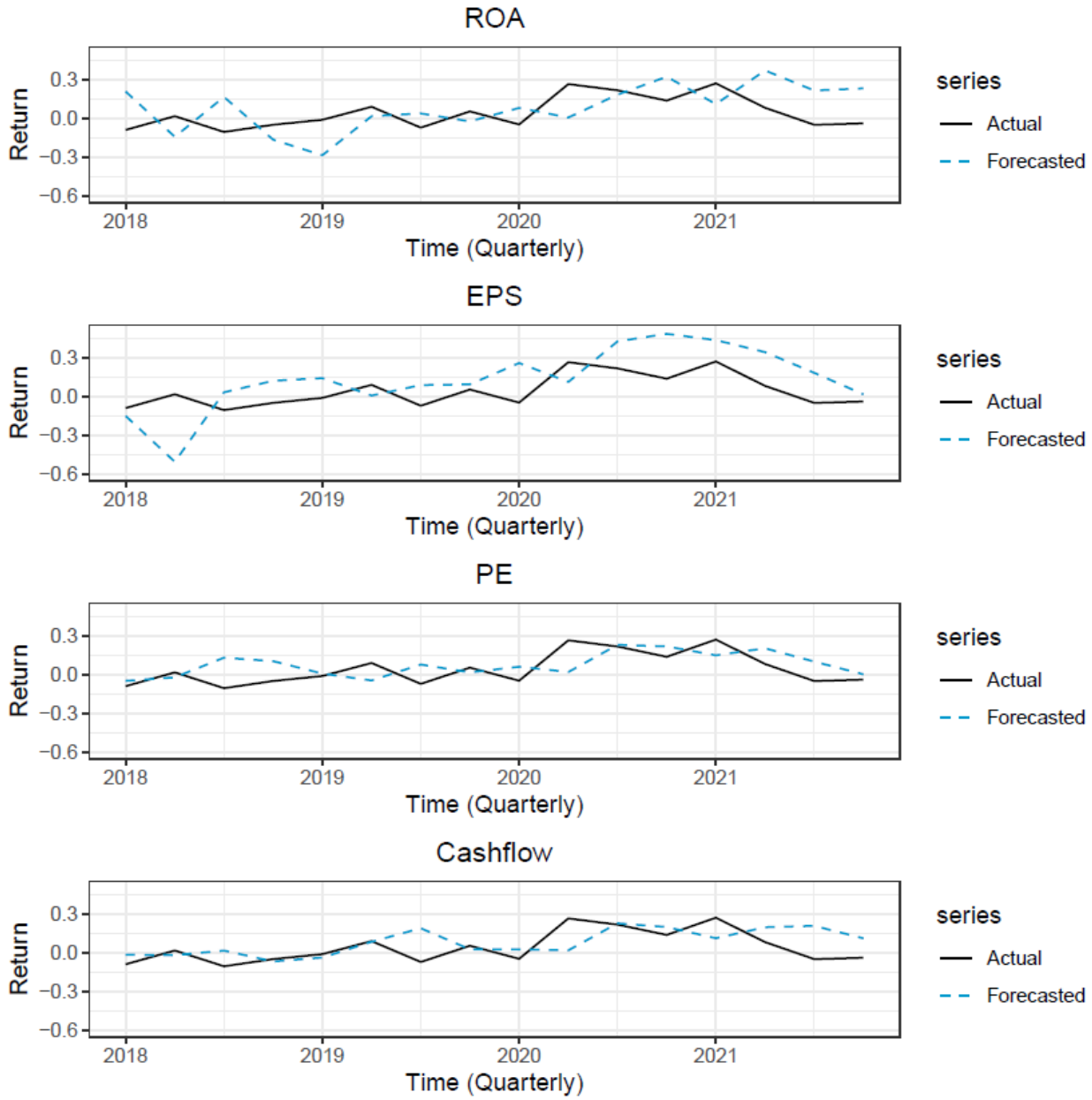
Source: prepared by the author based on the research

Annex 4. Forecasts of "Kauno Energija" share returns using leading indicators



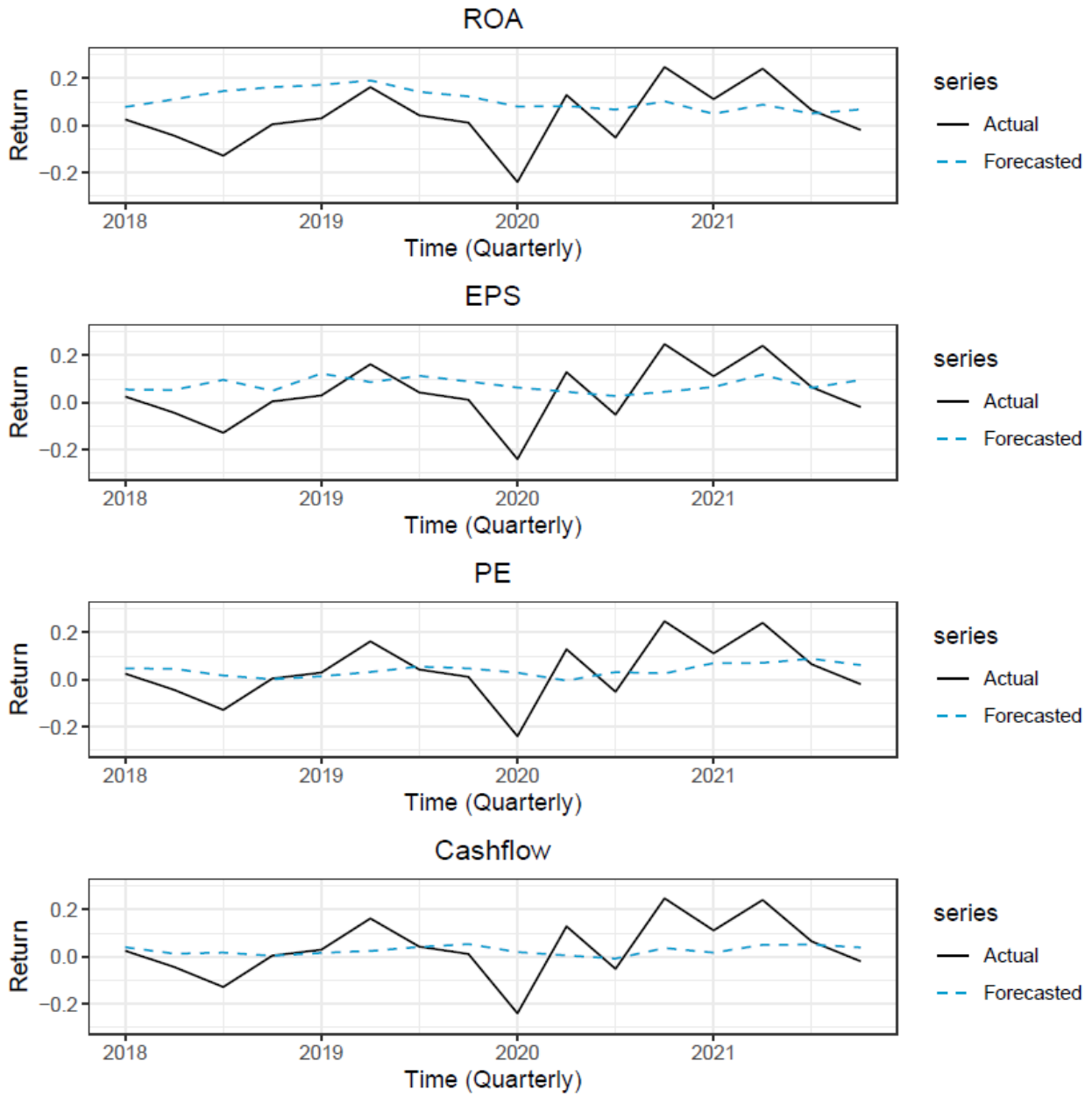
Source: prepared by the author based on the research

Annex 5. Forecasts of "Pieno Žvaigždės" share returns using leading indicators



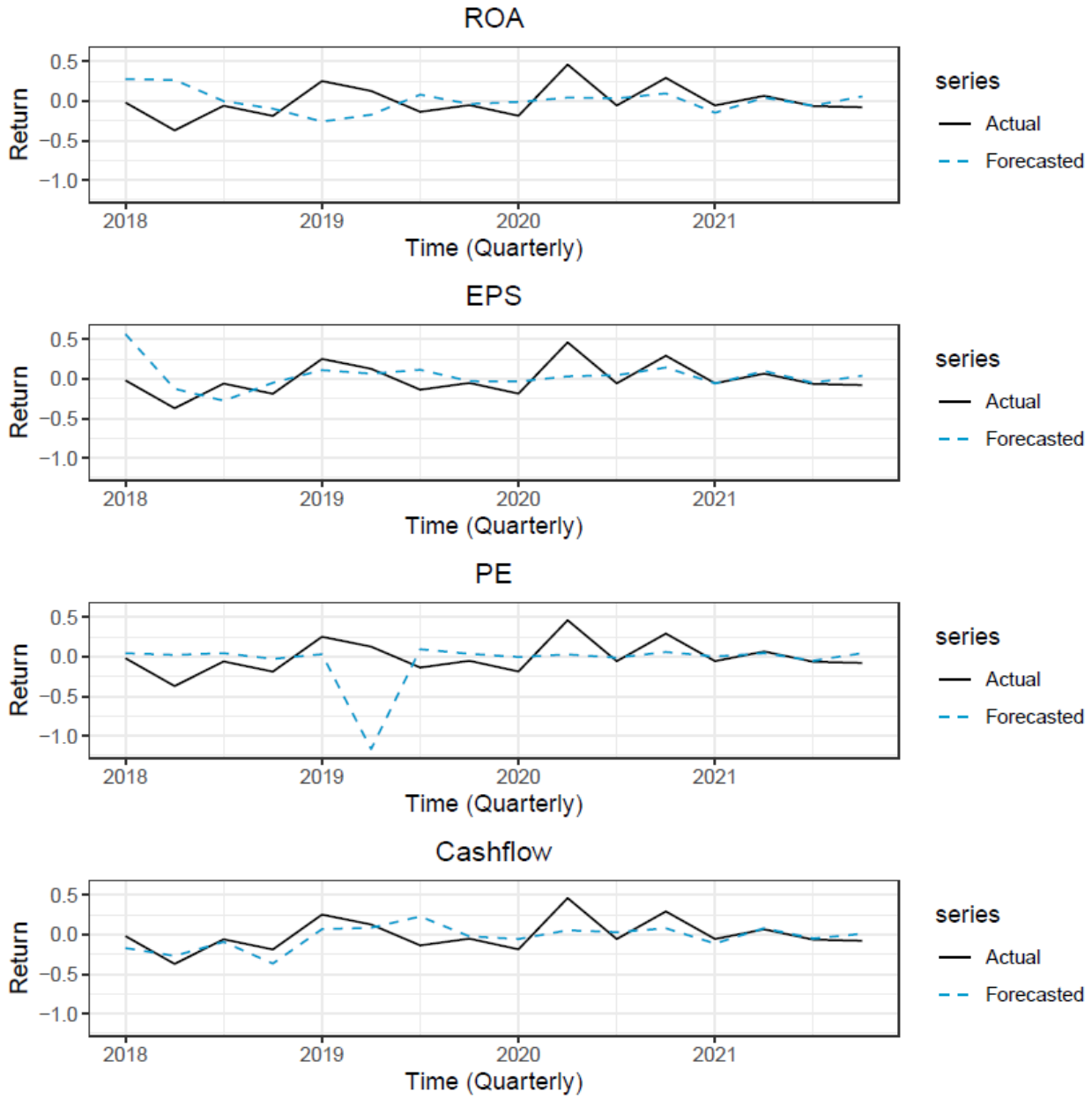
Source: prepared by the author based on the research

Annex 6. Forecasts of "Šiaulių Bankas" share returns using leading indicators



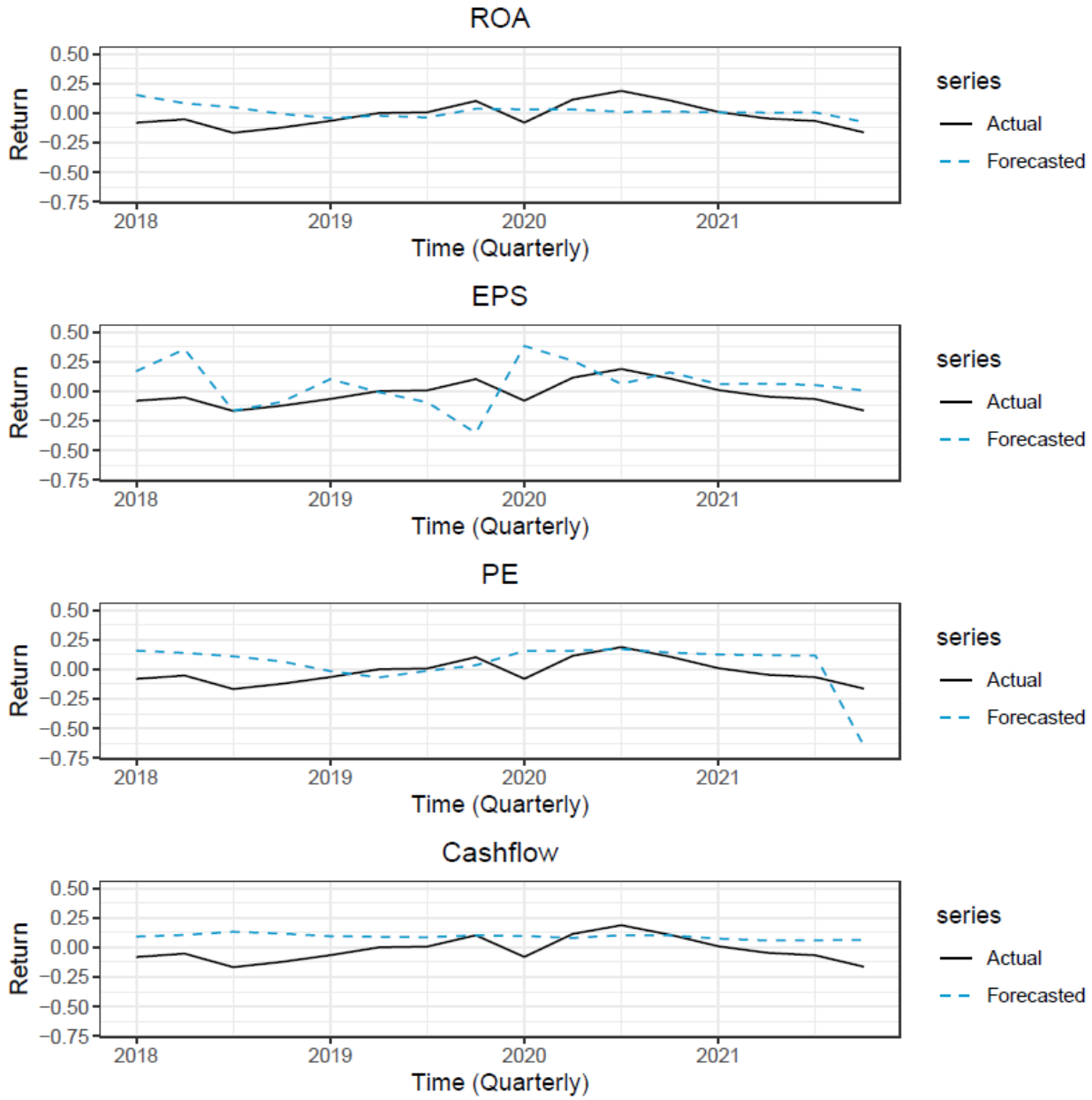
Source: prepared by the author based on the research

Annex 7. Forecasts of "Snaigė" share returns using leading indicators



Source: prepared by the author based on the research

Annex 8. Forecasts of "Vilniaus Baldai" share returns using leading indicators



Source: prepared by the author based on the research